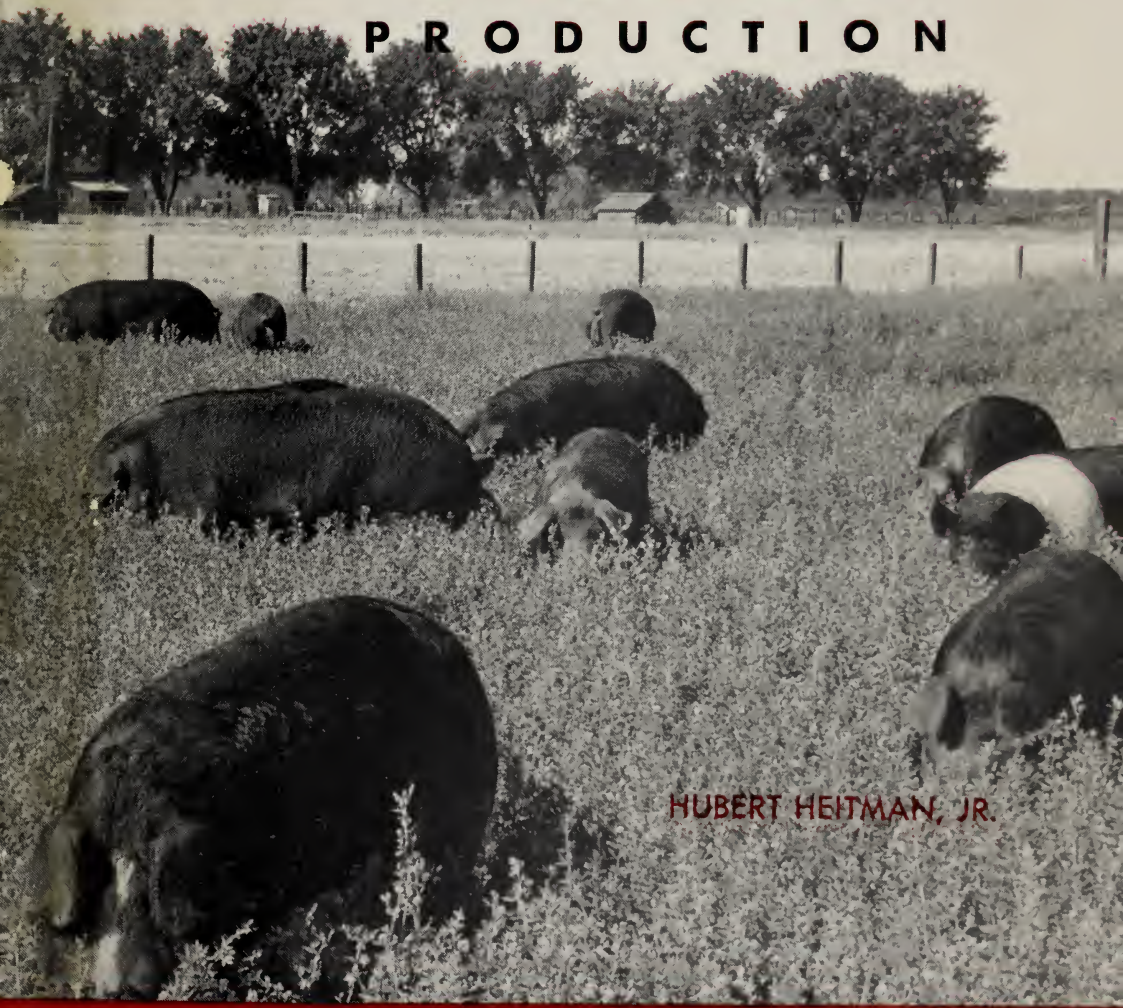
Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

CALIFORNIA SWINE PRODUCTION



HUBERT HEITMAN, JR.

CALIFORNIA AGRICULTURAL
Experiment Station
Extension Service

MANUAL 17

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CALIFORNIA

SWINE

PRODUCTION

HUBERT HEITMAN, JR.

UNIVERSITY OF CALIFORNIA COLLEGE OF AGRICULTURE
Agricultural Experiment Station and Extension Service

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SWINE RAISING in California ranges in scope from fattening a single animal for the family pork supply to large-scale garbage-feeding enterprises involving 5,000 or more hogs on as few as 20 acres. Large numbers of garbage-fed hogs are fattened near metropolitan Los Angeles and San Francisco, and many smaller hog farms are widely scattered throughout the San Joaquin and Sacramento valleys and other sections of the state.

The University of California at Davis usually has about 35 sows on its 17 acres of lots and pasture. Some commercial breeders of purebred hogs have about the same number on similar acreage, while hog men who fatten animals for market (and raise much of their own feed) generally average more acres per sow and, unless hogs are a sideline, have more sows.

Most hog raisers grow as much of their own grain as possible because it is expensive to buy feed. They also provide pasture, and often have access to some by-products feeds, such as skim milk or cull fruits.

Even if their hogs are not raised on a commercial scale, most farmers find that it pays to keep a few animals to make use of table refuse and waste feed. On almost every farm, enough feed is wasted to supply the family pork if fed to a few pigs.

If your feed and land costs are favorable, you will find that the advantages of hog raising in California generally outweigh the

drawbacks. Swine require a relatively small capital investment in breeding stock and equipment.

Because California imports annually more than half the pork it consumes (over a million head, live or dressed), an assured market seems certain for some time to come. This is especially true in view of the state's expanding population.

California markets usually pay more per hundredweight than the Omaha price because of the saving in freight charges.

The generally mild winters and moderate summers insure available pasture practically the year around. It is possible to raise two litters a year under these excellent climatic conditions.

Many fine pork producing feeds are grown on California's diversified farms. They include barley, wheat, grain sorghums, alfalfa, Ladino clover, and grass mixtures. Pigs also produce a profit from barley and rice stubble, by-products of the packing plant and dairy, cull fruits, and kitchen waste.

The main drawbacks to hog raising in California are higher production costs. In spite of the fact that many feeds are grown here, the state also imports vast amounts of wheat, oats, and corn each year, plus large tonnages of protein concentrates. This means higher prices because of shipping rates. Land and labor costs are also somewhat higher in California than in hog-belt states. Another item to be considered is the fact that artificial shade must be provided in summer if no natural shade is available.

THIS MANUAL

contains information for both the beginner and the experienced swine producer.

The material is based largely on Circular 15 (which it replaces). The second revision of the circular (1949) was made by the late Professor E. H. Hughes and Hubert Heitman, Jr.

To raise hogs successfully you will need to know about:

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OCTOBER, 1954

CALIFORNIA SWINE PRODUCTION

LAND and EQUIPMENT for hog raising can be fairly simple and inexpensive, with only a small capital investment.

The best place for a hog ranch is one where you can grow your own alfalfa, mixed grasses, or Ladino clover cheaply, where you can also grow barley or other feed grains at low cost, and where there is plenty of shade and water.

Locate your swine barn and lots where trees give natural shade and where drainage is good. This may be on the top of a gentle slope or where the soil is light and sandy. You will find that such locations make it much easier to keep hogs cool in summer and clean in winter.

Other factors that make for profitable hog raising are nearness to market, good shipping facilities, and rich soil to grow your own feed.

If you are located where dairy by-products are available, that is an advantage because they are excellent hog feeds. However, they are scarce, because most milk is sold as whole milk to processors who bottle it for city consumers.

If you grow rice or barley, you may find hogs profitable for gleaning.

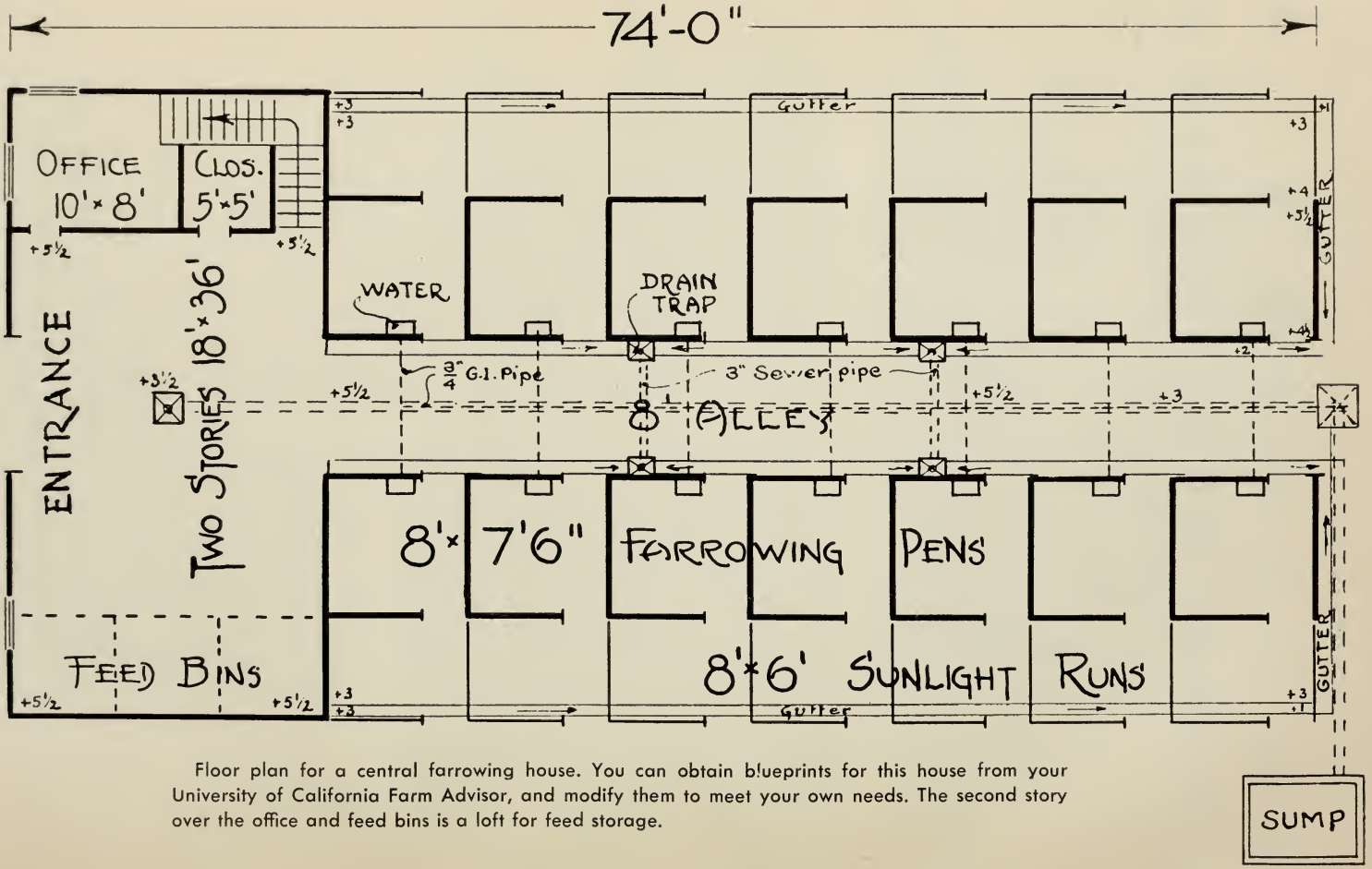
A concrete hog wallow is desirable, but not absolutely necessary. If you build one, it should be 8 to 10 feet wide, 14 to 16 feet long, and have a drain so it can be cleaned easily. You need to keep only 4 inches of water or less in the wallow, and this should be drained often and the wallow thoroughly cleaned. A film of crude or crankcase oil on the water will keep down lice and mange, and help keep the pig's hair in good condition. Locate the hog wallow where it can be reached easily by the pigs.

Tight fences are important. Woven wire 32 inches high is widely used. The diamond-mesh kind, with a barbed wire at bottom and top, is excellent.

For small lots, you can build a good fence from 1×6 inch rough boards, 4 boards high, with about 3 inches between the two bottom boards.

Wood, concrete, or steel posts are satisfactory. They should be only 8 to 10 feet apart, and may be even closer together.

Two kinds of central farrowing houses are used. The one shown on page 2 has pens for 14 sows. (If this plan does not meet your needs, your University of California Farm Advisor can help you modify it.) The other is simply a single row



Floor plan for a central farrowing house. You can obtain blueprints for this house from your University of California Farm Advisor, and modify them to meet your own needs. The second story over the office and feed bins is a loft for feed storage.

of farrowing pens—as many as you need or can conveniently build together—covered with a roof.

In both types, the partitions between pens should be at least 30 inches high, and may be built of wood, woven wire, or gas pipe. The farrowing pen should be at least 6 feet wide by 8 feet long. Each pen will take care of one sow and litter at a time or will provide shelter for five to seven 100-pound pigs. In each pen, a door should lead to a separate outside pen where the sow and her pigs can get direct sunlight and can exercise naturally. The floors of both inside and outside pens should be concrete or wood because a dirt floor is impossible to keep clean.

Each farrowing pen should have a guardrail about 8 inches above the floor and an electric brooder in one corner. You can make the guardrail from gas pipe or 2-inch lumber.

A simple farrowing box,

such as that shown in the picture, top right, can be easily constructed on the farm. The pigs can be put into it as they are born, to keep warm until the rest of the litter is farrowed.

An automatic waterer

will save labor and furnish fresh, cool water at all times. The waterer shown here is made of two concrete pipes set into a concrete platform. The outer pipe is 10 inches high, 3 inches thick, and 30 inches in diameter (inside). The inner pipe is 36 inches high, 2 inches thick, and 16 inches in diameter (inside).

The float and water pipe are inside the tall pipe. A small hole or holes at water level in the inner pipe lets the water into the basin, and a 2-inch hole in the outer pipe makes it easy to drain and clean the drinking basin.

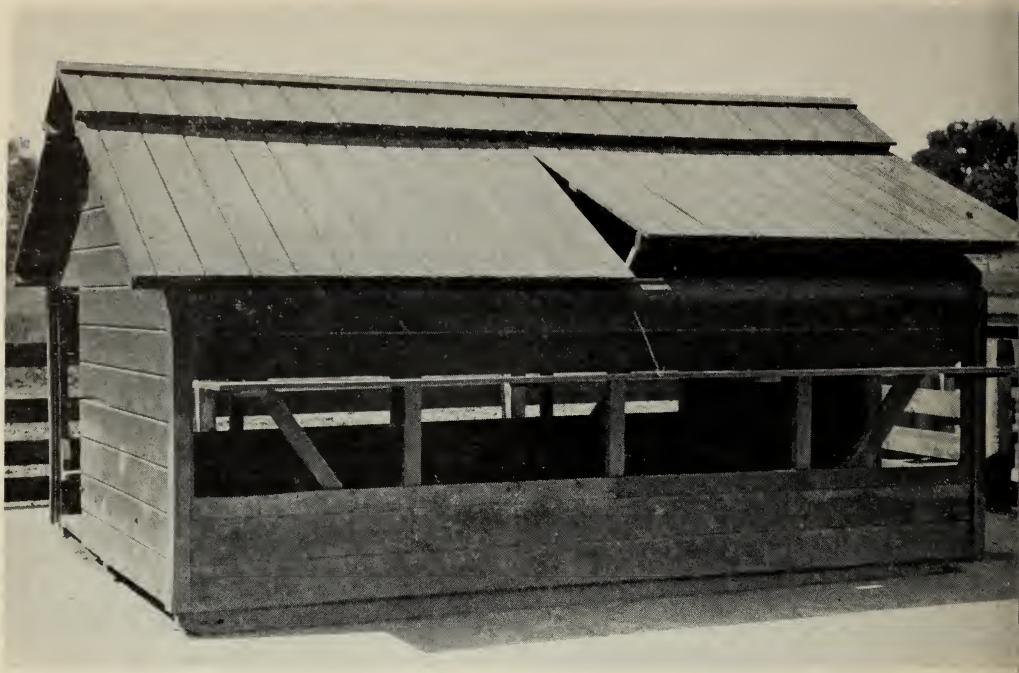
There are several types of automatic waterers either for gravity or for pressure systems. These may be ordered from livestock equipment supply houses.

Movable houses

are often used when the sows and litters are put on pasture (see top photo, p. 4). They are quite varied. The best type

A box like this keeps newborn pigs warm until they can be placed with the sow when she is through farrowing.

This automatic waterer was made from two sizes of concrete pipe, a float, some galvanized water pipe, and cement for a concrete base.



This type of house on skids can be easily moved to a fresh pasture. By putting a partition in the center, you can adapt the house so that it will shelter two sows and their litters.

gives protection from rain in the winter and provides shade in the summer. A good size is 8 feet wide by 14 feet long, with sides at least 3 feet high. This will accommodate two sows and their litters if a partition is put in the middle. A gable roof and a board floor are desirable. By building the house of 4×6 inch skids or runners, you can move it from one lot to another and thereby reduce the chances that the pigs will become infested with worms.

The price of these houses can be somewhat reduced by building them with one side open, in areas where weather is not too severe (see illustration).

A portable, three-sided shelter, with corrugated metal roof (below), gives good protection from the sun.

Portable shades

like the one shown on page 7 are inexpensive, and are very useful in California. The one shown on this page has a corrugated metal roof. Other types of shades can also be made, with roofing of hay or straw, solid wood or wooden strips, shingles, and the like. Shades should be tall enough for a man to get under without having to crawl.

An electric brooder

pays for itself many times over in saving small pigs. It is actually a triangular shelter fastened securely in one corner of

A pig brooder can be built in a corner of the farrowing pen. The 100-watt bulbs and reflectors provide warmth for baby pigs and draw them away from the sow so that there is less danger that she will injure them.

the farrowing pen (see photo, top of page). The two closed sides are about 3 feet long. A 100-watt bulb with a reflector is placed over a hole in the top of the brooder about 12 inches above the floor. This furnishes enough heat to draw the pigs away from the sow, so that there is less danger that she will step or lie on them. It costs only a few cents a day to operate this brooder.

Farrowing crates,

or farrowing jackets, are being used by hog men more and more frequently. Even though guardrails and electric brooders have helped prevent injuries, pigs may still be crushed by the sow. The crates are usually about 22 inches wide. This provides room enough for the sow to lie down or move backward or forward, but she cannot turn around. Thus losses from crushing are greatly reduced. (Where electricity is available, brooders are still effective in warming the pigs and drawing them from under the sow.)

These crates can be built into existing farrowing pens and made so that they may be removed. They can also be built into movable houses, with the sides run-

Farrowing crate keeps sow from turning around and accidentally crushing baby pigs.

BUILDING PLANS . . .

for the swine structures listed below may be purchased from:

Agricultural Publications
22 Giannini Hall
University of California
Berkeley 4, California

Please give the plan number when ordering, and make checks or money orders payable to The Regents of the University of California.

PLAN NO.		PRICE
13	Farrowing crate	$ .25
18	Portable shade. 12′ x 12′. Shed roof of corrugated metal	.25
40	Self-feeder made from 55-gal. oil drum	.15
81	Breeding crate	.25
85	Shipping crate	.15
119	House, shed roof, movable	.25
120	House, gable roof, movable	.25
121	Farrowing house, community. Shed roof	.75
144	Farrowing barn, two-story, feed and office section	1.00
172	Hoof trimming crate	.25
195	Waterer. All concrete	.15
234	Self-feeding pig creep, gable roof	.15

ning back from the door. The sides of the crates have an over-all height of about 36 inches. The lowest part is adjustable so that it can be 8 to 12 inches from the floor, depending on the size of the sow. When the sow is lying down, pigs can nurse her.

Besides lowering the incidence of losses from crushing, these structures make it possible for more sows to be farrowed in crates in a given floor space. It is also much easier to handle sows in crates. On the other hand, the sow may become lazy through lack of exercise, and somewhat more labor will be involved during farrowing.

As a general practice, sows are placed in the crates a few days before farrowing and left in them until the pigs are 3 to 5 days old. The sows can be left in longer if they have access to an outside pen for exercise.

A creep

for suckling pigs can be fenced off in a corner of the lot (see opposite page). A small trough or self-feeder can be placed inside, where only the small pigs can get at it.

Another type of feeder is the portable self-feeding creep (see opposite page). While more expensive than the fenced corner of a lot, it reduces operative labor because it is a self-feeding device and can be easily moved.

Self-feeders,

such as that shown on the opposite page, can be used either for a single feed or for a mixture (see page 37). A small pig needs about a 6-inch trough space, a full-grown hog about a 16-inch space. But several pigs can eat in succession from the same space, so that the feeder shown can be used for a herd of 20 to 30 hogs.

You will need to inspect each feeder at least once a day to be sure that feed is not being wasted and that the feed opening has not become clogged.

Commercial garbage-feeding plants

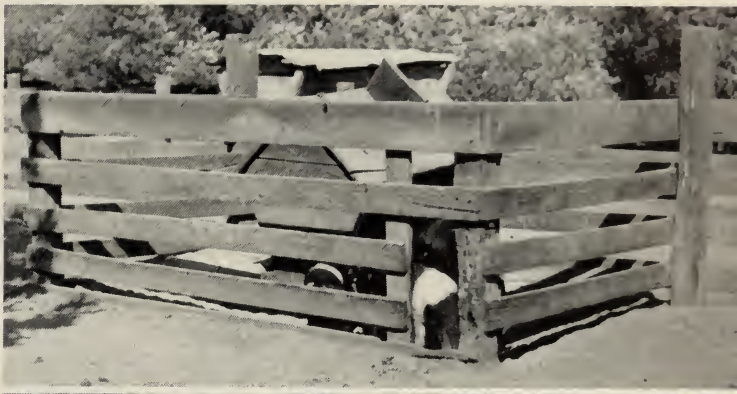
need special equipment. This is briefly discussed on pages 43 to 45.

An alfalfa rack

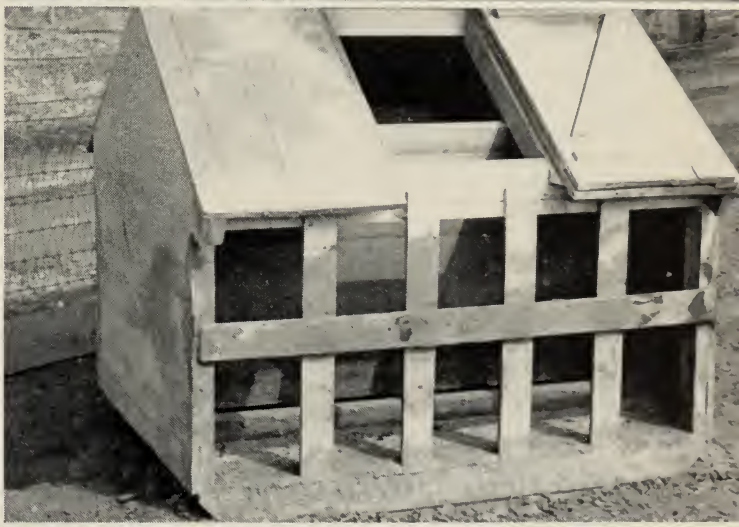
can be of benefit when hogs are not on green pasture. If alfalfa (or other legume) hay is placed in it, hogs gleaning stubble fields or hogging-down ripe cereal crops will have access to a feed containing carotene (vitamin A).

A portable shade of this type is relatively cheap and lightweight. It can also be built with a simple shed roof instead of corrugated metal.

By placing a self-feeder inside the creep, you can keep the sow from eating rations intended for the young pigs.



A portable self-feeding creep is practical and easy to build.



This self-feeder is large enough for 20 to 30 fattening pigs. Two or three pigs can take turns at one space.

CHOOSING YOUR BREEDING HERD is an important consideration. Always use a purebred sire and, if possible, purebred sows.

The type in lard hogs

has changed greatly in recent years. Before 1910 or 1920 many animals were too short, wide, and fat. On the other hand, a very long-legged, rangy hog is likely to be a poor feeder. Now the preferred type is between the two—a medium-legged animal, deep and moderately long.

Probably this shift happened because producers realized that a medium-legged hog grows faster and is a better rustler, and because consumers' demands also changed. This change in type may partly explain why the average brood sow raises a larger litter now. Probably her added length and depth have given her more capacity, which in turn has raised her milk production.

It makes no difference which breed you choose.

That will depend upon your own preference. All breeds fatten in about the same time, and are affected in about the same way by weather and climate, except that breeds that are predominantly white sometimes sunburn.

Most California growers raise lard hogs. The common lard breeds are Berkshire, Chester White, Duroc, Hampshire, Poland China, Spotted Poland China, and some Herefords. There are only a few small herds of bacon hogs, the Large Yorkshire and Tamworth.

When building your breeding herd,

remember these five important points:

1. *Always get a purebred sire,* and purebred sows too, if you possibly can. If you cannot begin with purebred sows, get the best available grade animals with good type and conformation.

2. It is safest to buy from a reliable person or firm.

3. Two-year-olds and over are seldom, if ever, bought for breeding.

4. If you buy a young boar or gilt, do not choose one that seems too mature for its age. A deep, moderately long animal with straight, strong legs and back, that shows smoothness and quality throughout, is to be preferred.

5. It is often more convenient and just as cheap to buy gilts already bred to a purebred boar.

Within certain limitations you can tell an animal's value as a breeder in three ways: by type, by pedigree, and by the progeny.

The brood sow

should produce pigs that will make good feeders, gain fast, finish at a marketable weight, dress out profitably, and meet consumer demands. These are the kinds of animals you want your breeding herd to produce. Therefore, you should keep those desirable qualities in mind when buying your breeding animals.

The brood sow should be a regular breeder and raise large litters. You can get some idea as to whether she will be this kind of animal if you know how large the litters of her sire and dam were. You also ought to consider uniformity of type, color markings, and similarity of bloodlines when choosing the sow herd.

The ideal brood sow should be big, have large, clear eyes and medium-sized ears, be neat in the jowl, and have a

strong muzzle and good width between her eyes. Her back and loin should be strong and slightly arched. She should be smooth about the shoulders, and have long, deep, smooth sides. Her hams should be deep, full, and not flabby. Her udder should be well developed and have at least 10 to 14 teats.

She should have straight, strong legs, not too close together, with bone of good quality, and short pasterns. Her chest should be deep and wide—not pinched—showing a strong constitution. Fine hair, smooth outline, femininity, and refinement about the head indicate quality. She should be even-tempered, easy to handle, not irritable. A nervous sow raises fewer pigs.

When the pigs are weaned, check the records and sort out for fattening those sows that for some reason raised small litters or pigs of poor type and quality.

The boar

should be purebred, since most of the improvement of the herd comes from a good herd sire. There is no excuse for using a grade or scrub boar. Your purebred boar should come from a prolific family so that his gilts will have the ability to produce large, healthy litters.

It is a good idea to wait until the boar is at least 4 months old before choosing him for a herd sire. It is practically impossible to guess at weaning time how a pig will develop. But any serious defects will show up by 4 months of age.

The boar should be large, rugged, and strong. He should show his masculinity in a strong muzzle, large, clear eyes, somewhat larger ears than those of a sow, a strong neck, and well-developed shoulders. He should have straight, strong legs with plenty of bone. His pasterns should be straight and short. His body should be thicker than a sow's body, with a wider back. His back and loin should be strong and slightly arched. His sides should be deep and smooth, with full hams. His sex organs should be well developed.

The boar does not show so much refinement as the sow, but coarseness is bad, especially wrinkles and creases on his shoulder or side.

Temperament in the boar is just as important as in the sow. An irritable boar is hard to handle. This kind should not be chosen unless he has extraordinary qualities needed in the herd.

This is an example of a good type of brood sow. Note the arched back, smooth shoulders and sides, full hams, well-developed udder, and straight, strong legs.

FEEDS for GOOD GROWTH must be combined for a balanced ration . . . no one feed provides all required nutrients.

There are five classes of feeds for hogs:

1. Carbonaceous concentrates,

such as grains and dried fruits, which have large amounts of starch and sugar, some fat, and only a little protein. The starches, sugars, and fats produce energy, which is used up day by day in the ordinary body processes, stored as fat, or used for milk production.

2. Protein supplements,

including dairy, packing-house, and fish by-products, linseed, cottonseed, and soybean meals. Alfalfa hay and meal are also classed as protein supplements. All of these produce growth. Most animal by-products contain all the different proteins hogs need. But most plant products and by-products do not; their proteins are usually incomplete.

3. Forage crops,

which contain minerals, vitamins, some starch and sugar, and give variety to the ration. Legume pastures also supply protein and may partially replace protein supplements.

4. Salt mixtures, or minerals,

necessary for good bone growth and other body processes if salts are lacking in the rest of the ration.

5. Vitamins or vitamin carriers,

needed for growth, normal reproduction, and other functions. Many hog rations fed in California are low in vitamin A and parts of the vitamin B complex, because many feeds are low in these vitamins. In plants, vitamin A occurs in the form of carotene.

Hogs need

starch or sugar, protein, minerals, vitamins, and some fat, and they can get these nutrients from various combinations of the five classes of feeds. Most hogs are fed at least some feed from each class.

Hogs need more protein supplements and can use less roughage than cattle and sheep because they have a different kind of digestive tract. Usually, high-protein feeds must be purchased to supplement such common home-grown feeds as barley, grain sorghums, corn, rice stubble, and cull fruits.

1. Carbonaceous Concentrates

Barley

is used more than any other cereal grain as a hog feed in California. It contains more protein (table 1) and therefore requires less protein supplement than does corn. Bacon and hams produced from barley are superior in quality.

However, barley is low in vitamins A and D, calcium, and possibly in some of the B vitamins. Its proteins are incomplete for good growth. Pigs fed barley, or barley and wheat-flour middlings in dry lot need more protein. Either an animal protein, or a plant protein from a legume, such as soybean meal, green alfalfa, or alfalfa hay, or a combination of animal and plant proteins, may be used.

Barley is somewhat less valuable,

pound for pound, than is corn, because it contains more fiber and therefore fewer total digestible nutrients.

Corn

is the most important pork-producing feed in the United States, but very little of it is grown in California. In total digestible nutrients, it equals or exceeds all other important carbonaceous feeds. Because it is relatively low in proteins and high in starch and fats, it is better for fattening pigs than for growing them. Corn plus skim milk, buttermilk, tankage, or fish meal produces rapid and efficient gains in growing and fattening pigs. Because of its carotene (vitamin A) content, yellow corn is better than white when corn is fed alone.

Wheat

produces faster and more efficient gains than either corn or barley when it is ground and fed alone or with protein

Table 1.—Nutrients Contained in 26 Carbonaceous Concentrates

Feed	Total dry matter in 100 pounds	Digestible nutrients in 100 pounds		Crude protein	Mineral matter in 100 pounds		
		Digestible protein	Total digestible nutrients		Total mineral matter	Calcium	Phosphorus
	pounds	pounds	pounds	per cent	pounds	pounds	pounds
Barley (Pacific states)	90	7.7	79	9.5	2.7	0.08	0.36
Brewers' grains (wet)	24	4.2	16	5.7	1.0	0.07	0.12
Corn	85	6.6	80	8.6	1.2	0.02	0.27
Wheat (Pacific states)	89	8.3	80	9.9	1.9	....	....
Oats (Pacific states)	91	7.0	72	9.0	3.7	....	....
Rye	90	10.0	76	12.6	1.9	0.10	0.33
Kafir grain	90	8.8	82	10.9	1.6	0.02	0.31
Milo grain	89	8.8	80	11.3	1.7	0.03	0.30
Sorghum grain, sweet	89	5.8	78	9.5	1.6	0.02	0.28
Feterita grain	89	9.5	80	12.2	1.7	0.02	0.33
Kaoliang	90	8.2	82	10.5	1.9	....	....
Rice (rough)	89	6.0	70	7.9	5.2	0.08	0.32
Rice (brewers')	88	5.7	76	7.5	0.8	0.04	0.10
Rice bran	91	8.5	67	12.5	13.5	0.08	1.36
Rice polish	90	9.7	81	12.8	9.6	0.04	1.10
Molasses, beet	81	4.4	61	8.4	10.1	0.08	0.02
Molasses, cane	74	0.0	54	2.9	9.0	0.74	0.08
Figs, dried	75	4.0	69	5.4	2.1	....	....
Prunes	85	0.7	66	5.7	1.8	....	....
Raisins	81	3.4	69	4.5	2.1	....	....
Artichoke tubers	21	1.2	16	2.0	1.7	....	0.06
Beets, sugar	16	1.2	14	1.6	1.1	0.04	0.04
Potatoes, tubers	21	1.3	18	2.2	1.1	0.01	0.05
Sweet potatoes, tubers	32	0.2	26	1.6	1.2	0.03	0.04
Pumpkins, field	10	1.3	9	1.7	0.9	....	0.04
Potato meal	93	3.7	71	10.4	4.3	0.08	0.22

Data for barley are averages of analyses from western experiment stations. Data for dried figs, raisins, and prunes are from analyses of California Agricultural Experiment Station. All other figures are from Feeds and Feeding: a Handbook for Student and Stockman, by F. B. Morrison, pp. 1086–1131, published in 1948. Reprinted with permission of the Morrison Publishing Company, Ithaca, N.Y.

A mixture of barley and rape makes a good pasture for winter or early spring. (See page 18.)

supplements. However, because of its cost, little is fed to livestock.

Oats

are excellent for brood sows, boars, and young gilts which are kept in the breeding herd. Oats can be fed alone or with barley and other feeds. As with barley, if you feed oats to hogs, you will need to add a protein supplement. Oats should not be used for fattening young pigs because this grain is too high in fiber content and fairly low in total digestible nutrients.

Rye

contains a little more digestible protein than does barley, and slightly fewer digestible nutrients, but very little is grown in California.

Grain sorghums,

especially kafir and milo, are popular hog feeds in California and other southwestern states. Producers say these products are almost as good as corn for growing and fattening pigs.

Total digestible nutrients are about equal for all sorghums, and the ratio between protein content and carbohydrates and fats is about the same. However, the proteins are incomplete, which means that you must feed some protein supplement to your pigs and brood sows if they have no alfalfa or other legume pasture. Sorghums are also low in calcium and vitamin A. Because they are extremely hard, they should be ground or rolled.

Rough, or paddy, rice

makes good hog feed in the dry lot when it is ground finely and self-fed (see page 40) with tankage. In this form, it compares well with barley in daily gain and feed required per 100 pounds of gain. When rough rice is fed whole or cooked, even with tankage, it is poor hog feed.

Do not feed rough rice to small pigs, even if it is finely ground, because little pieces of rice hulls injure the walls of the stomach and small intestines.

Hogs over 100 pounds do well on rice stubble (see page 43).

Rice bran

is a good feed if you use it with a protein supplement and barley, grain sorghums, or corn; but it has somewhat lower total digestible nutrients than barley. Rice bran has two major defects: it contains more fiber than most concentrates, and it will produce soft or oily pork if fed alone for a long time. You should never feed rice bran alone to growing or fattening pigs. If you feed 30 per cent or less of rice bran in the ration, you need not worry about soft pork.

Rice polish

is a more efficient feed than rice bran and has much less tendency to produce

soft pork. Because its fiber content is very low, it contains even more digestible nutrients than barley or corn. However, it should always be fed with a protein supplement and another carbonaceous feed because it is laxative. Pigs self-fed rice polish and tankage will gain about as fast as those fed barley and tankage, though they may eat a little more tankage and less grain.

Cassava, or manihot meal,

has large amounts of starch but very little protein. It should be supplemented with proteins for all classes of pigs.

Molasses

can be substituted for part of the grain ration when it is cheap. But molasses should make up less than 20 per cent of the total ration. Molasses is less frequently fed to hogs than to other livestock. Beet molasses is more laxative than cane molasses, and should be fed with more care. It contains a little protein but has less calcium and phosphorus than cane molasses (table 1).

Low-grade and cull raisins

are rich in sugar, usually exceeding 60 per cent. They are a good feed for growing and fattening pigs if you feed both a protein supplement and barley or some other grain with them. They should be fed only up to 25 or 30 per cent of the ration. If you feed raisins alone, or raisins with a protein supplement, pigs often scour severely. This is true either in dry lot or pasture. Pound for pound, raisins are not so valuable as barley for fattening pigs.

Dried figs and prunes

have about the same feeding value as raisins, and should be fed with barley or grain sorghums and some protein supplement.

Tubers and vegetables,

such as artichokes, beets, cooked potatoes, sweet potatoes, and pumpkins, give variety to the diet and furnish some feed value. Hogs relish them, but they are low in total digestible nutrients and high in water.

Potato meal

is made by drying potatoes artificially, or in the sun in the southern San Joaquin Valley, and then grinding them. It has a feed analysis much like barley. It should be fed in small amounts with other feeds, probably 25 to 40 per cent in the ration for pigs weighing 100 pounds or more; for younger pigs, about 10 per cent should be fed.

2. Protein Supplements

If your hogs are not on a legume pasture, such as alfalfa or Ladino clover, they will need a protein supplement. Even on legume pasture, gains are better if some protein supplement is fed. Table 2 compares common protein supplements.

Skim milk and buttermilk

are the best supplements to balance the lack of proteins in grains. The milk proteins are relatively complete as compared with those of grains. These two dairy products also carry plenty of calcium and phosphorus and thus help to balance the lime deficiency of the grains. Parts of the vitamin B complex are found in them. These nutrients are needed for reproduction, for production of milk, and for normal growth. Hence milk by-products are especially valuable for the brood sow and young pigs.

The difficulty is that skim milk and buttermilk are scarce and relatively expensive. Most milk in California is sold as market milk instead of being processed for cream and butter, with resulting by-products available for use as

Table 2.—Nutrients Contained in 20 Nitrogenous or Protein Supplements

Feed	Total dry matter in 100 pounds	Digestible nutrients in 100 pounds		Crude protein	Mineral matter in 100 pounds		
		Digestible protein	Total digestible nutrients		Total mineral matter	Calcium	Phosphorus
	pounds	pounds	pounds	per cent	pounds	pounds	pounds
Skim milk	10	3.4	9	3.6	0.7	0.13	0.10
Buttermilk	9	3.3	9	3.5	0.8	0.14	0.08
Whey	7	0.8	7	0.9	0.7	0.05	0.04
Skim milk, dried	94	31.2	81	34.7	7.8	1.30	1.03
Buttermilk, dried	92	29.2	84	32.4	10.0	1.36	0.82
Whey, dried	94	11.0	78	12.2	9.9	0.86	0.72
Tankage (60 per cent)	93	51.5	68	60.6	20.2	6.37	3.23
Meat and bone scraps (50 per cent)	94	41.8	65	51.0	29.1	9.71	4.81
Fishmeal (over 63 per cent)	93	60.1	74	66.8	15.6	....	....
Linseed meal (old process)	91	30.8	77	35.4	5.6	0.39	0.87
Cottonseed meal (43 per cent)	93	36.4	76	43.9	6.4	0.23	1.12
Coconut meal (old process)	93	18.1	78	21.3	6.2	0.21	0.64
Soybean meal	91	37.2	78	44.3	6.0	0.29	0.66
Wheat-flour middlings	89	16.1	79	18.3	3.1	0.09	0.71
Wheat bran	90	13.7	67	16.9	6.1	0.14	1.29
Beans, field	90	20.2	79	22.9	4.2	0.15	0.57
Pea seed, field	91	20.1	78	23.4	3.0	0.17	0.51
Cowpeas	89	19.2	76	23.4	3.5	0.11	0.46
Alfalfa meal (good)	93	11.8	54	16.1	9.1	1.32	0.19
Alfalfa, green	25	3.4	15	4.5	2.3	0.35	0.07

These data are taken from Feeds and Feeding: a Handbook for Student and Stockman, by F. B. Morrison, pp. 1086–1131, published in 1948. Reprinted with permission of the Morrison Publishing Company, Ithaca, N.Y.

feeds. But if you have a few cows of your own, you may have some skim milk or buttermilk for your hogs. Or you may be able to get some if you are in a district where milk is sold for market cream or butter.

Undiluted buttermilk has about the same chemical make-up and total digestible nutrients as skim milk. It is as good as skim milk when fed with corn, and almost as good when fed with barley.

These dairy by-products should always be pasteurized before being fed to hogs. This will help prevent diseases caused by unpasteurized products.

You can feed skim milk or buttermilk separately or with barley or other grain or grain mixtures as a slop. You will get excellent results and have a slop with about the right consistency by using 1 pound of rolled barley or grain mix to 3 pounds of liquid. If you have plenty of these dairy by-products, feed 1 pound of grain for each 5 or 7 pounds of liquid.

Whey has considerable feed value as a supplement to grains, even though it is lowest, among the protein supplements, in amounts of digestible nutrients and protein. Most of the protein is re-

moved during the cheese making or when casein is produced. It takes more whey and grain than skim milk and grain to produce 100 pounds of gain.

Despite these drawbacks, whey produces fair gains. The protein that is in it seems to be of good quality. Like skim milk, whey contains parts of the vitamin B complex. Three lots of 50 pigs each, averaging approximately 69 pounds each, were fed 3, 5, or 7 pounds of whey for each pound of barley, with 1 per cent salt. There was very little difference in the amount of dry matter required per pound of gain among the groups. While the gains were not rapid, the pigs seemed thrifty and the heavier pigs in each lot were in excellent condition. There was little or no difference in shrinkage on the way to market, or in yield and quality of carcasses among the three lots.

Like other dairy by-products, whey is scarce. You will probably be able to get it only if there is a cheese or casein factory in your district. But it is worth using if it is available. It is fed like skim milk, and should be pasteurized.

Dried skim milk and buttermilk

contain a little more than half as much protein as tankage, and are priced somewhat higher. Because of their price, they are not often used for hog feeding, and there is little information about them. In one test at the University of California, pigs were fed rolled barley and dried buttermilk. They gained about 1½ pounds per head daily and consumed about 350 pounds of barley and about 35 pounds of dried buttermilk per 100 pounds of gain.

Tankage and meat scraps

are among the best hog feeds because:

1. They are extremely rich in digestible protein.

2. These proteins combine well with those of cereal grains to produce fast growth.

A convenient arrangement of feed bins and weighing equipment, like this, will save time and energy.

3. They have large amounts of calcium and phosphorus.

4. They are a safe feed to use because they are cooked under high pressure and are dried thoroughly.

Pork producers everywhere feed tankage and meat scraps. Dairy products and fish meal are the only other protein feeds that rank higher with hog feeders.

In trials with pigs at the University of California Experiment Station, tankage fed with barley gave average daily gains of about 1.4 pounds, as compared with 1.6 pounds when skim milk was used with barley. The pigs fed barley and tankage averaged 444 pounds of barley and 41 pounds of tankage per 100 pounds of gain. Those fed barley and skim milk averaged 325 pounds of barley and 692 pounds of skim milk (which would contain about 66 pounds of dry matter).

Because of its high protein content, only 1 part of tankage or meat scraps to 10 parts of barley or corn by weight need be fed to produce excellent gains on hogs in dry lot. This small amount is enough for brood sows and boars, too. If you have alfalfa or other green pasture, you can feed even less tankage.

Very young pigs will do better if you add wheat middlings to their barley and tankage ration.

A standard 60 per cent protein tankage is recommended.

Fish meal

has produced surprising results in feeding tests. It contains more digestible protein than does tankage. Fish meal contains about 15 per cent ash or mineral matter, second only to tankage, and much of this is calcium and phosphorus.

A summary of experiments in various experiment stations shows that pigs fed a carbonaceous concentrate with fish meal gain faster and require slightly less feed than do pigs fed a carbonaceous concentrate and tankage.

Wheat bran is an excellent feed

to add to a brood sow's ration, both before and after farrowing, because it is bulky and slightly laxative. For pigs that are off feed or doing poorly, you can feed from 10 to 25 per cent of it in their ration. Wheat bran is not a good feed for fattening pigs because it is bulky and low in protein.

Wheat middlings, or shorts

are low in protein, but still are popular with hog feeders. You can get excellent results with young growing pigs on pasture, before and especially after weaning, by feeding them a mixture of wheat middlings, rolled barley, and either skim milk, fish meal, or tankage.

Linseed meal

is not used much in California except by hog men fitting purebred hogs for the shows. A ration of barley, linseed meal, and fish meal, tankage, or skim milk gives excellent results in fattening hogs, but barley and linseed meal alone produce poor gains. This is because their proteins are incomplete.

Coconut meal,

when not rancid, can be fed with barley to pigs on alfalfa pasture. Use 1 part coconut meal to 3 or 4 parts of grain by weight. When you feed coconut meal and barley in dry lot, always add alfalfa meal and some animal protein, such as skim milk, tankage, or fish meal.

Cottonseed meal

may have some toxic effects if fed in large amounts. If you feed 10 per cent or less in the ration, with alfalfa pasture or hay, you should have no trouble. Although cottonseed meal has about 30 per cent less protein than does tankage, in California it is usually the cheapest protein supplement. It is therefore economical for use in the ration of swine. A combination of one-half to two-thirds of the protein supplement as cottonseed meal

and the rest as tankage, meat scraps, or fish meal will give excellent results with pigs on pasture.

Soybean meal,

with its high protein content, produces good gains when fed with barley or corn and alfalfa meal or some animal protein such as tankage. This feed is not grown much in California, but more of it has been fed since 1938.

Field peas,

when they can be grown successfully with oats or barley, make fine feed for hogging-down. Milo and cowpeas also make an excellent mixture for hogs to pasture off, with or without other grains.

Navy or lima beans

supply both energy and protein; hence they can be used to replace part of the barley as well as part of the tankage. Do not feed beans alone, because this will probably result in a soft carcass. You can use from 15 to 30 per cent in a ration with barley and a small amount of tankage. Beans have little vitamin A and lime; when you feed them you should give the hogs some form of lime, and alfalfa or other pasture.

Raw beans have a bitter taste, and hogs will not eat them. They should be cooked or steamed before being fed to the hogs. If you salt the water during cooking, the beans will taste better. The cooked beans do not keep well, and only one or two days' supply can be cooked at a time. Steaming for 30 minutes gives just as good results as cooking. If the beans are then dried and ground, they will keep, and large lots can be prepared at a time.

Alfalfa hay, meal, and leaves

carry an excellent variety of proteins. They also are high in lime and many vitamins. These nutrients produce the excellent results you get when you add chopped alfalfa hay or alfalfa meal to a ration of barley and protein feed, such as wheat middlings, soybean meal, or tankage. From 5 to 10 per cent alfalfa by weight is usually enough to add to such a ration. For hogs, chopped alfalfa hay or coarsely ground alfalfa meal or leaves are better than unchopped hay or finely ground meal.

Alfalfa feeds are too bulky to feed young growing pigs in large amounts. However, during wet winter months when you cannot use alfalfa pasture, you should always feed chopped alfalfa hay regularly to brood sows and a little to growing pigs. (Alfalfa pasture is discussed under "Forage.")

3. Forage

You will gain three important advantages by pasturing your pigs on alfalfa or other forage. They are:

1. Healthier pigs.
2. Faster gains.
3. Less feed for 100 pounds of gain.

On pastures, pigs can exercise naturally; they get direct sunlight; and the variety of proteins, vitamins, and minerals in the forage produces thrifty, healthy, fast-growing pigs. All this applies to brood sows, boars, growing and fattening pigs alike.

Best of all, when grain is high-priced or scarce, you can grow hogs with the least amount of concentrates *if the animals also have pasture*. Legume forages (especially alfalfa) cut the amount of protein supplements you must buy to balance the ration or put on 100 pounds of gain.

Alfalfa pasture

is an excellent forage crop for pigs—some people say it is the best—for these reasons:

It produces a large tonnage per acre.

It can be grazed for a long time.

It is palatable.

It is high in calcium and vitamin A.

Its proteins help to balance the grain proteins.

No other forage is used more widely than alfalfa for brood sows, both before and after farrowing.

You can get excellent gains with pigs weighing 50 to 200 pounds by pasturing them on alfalfa, and also feeding a ration of 15 parts rolled barley and 1 part tankage, by weight.

Ladino clover and mixtures

of it with grasses have replaced alfalfa on some farms since Ladino was developed as a pasture crop. The food nutrients in these mixtures are about the same as those in alfalfa. They may be grown on some soils that are too shallow or heavy for alfalfa, or where alfalfa does poorly because of diseases or weeds. They stand pasturing very well, even on sandy soils. One drawback is that they need to be irrigated often.

Sudangrass

yields a heavy tonnage if you get a good stand, and therefore is fast becoming popular as a summer pasture. It provides less variety of proteins than alfalfa, and less calcium and phosphorus.

Barley, field peas, and vetch,

mixed together, have given excellent results, according to some hog raisers. This mixture furnishes carbohydrates and a variety of proteins and minerals, but will not stand severe pasturing.

A mixture of barley and rape

can be substituted where alfalfa, Ladino clover, or other legume pastures cannot be sown. If you seed them in September or October, barley and rape provide excellent winter pasture just when alfalfa grows slowly. Or you can sow them for early spring pasture in January or February. About 50 pounds of barley and 8 pounds of Dwarf Essex rape per acre is a good seed mixture. It can be drilled or broadcast. You will get best results by letting it grow 8 to 12 inches tall before turning your pigs or brood sows in on it.

4. Salt Mixtures

Hog raisers have long known that a balance between proteins and carbonaceous nutrients (starches, sugars, and fats) is needed for good growth. But only in recent years have the many cases of stiffness and rickets in hogs brought out the importance of salts for normal growth of bones.

Calcium (lime)

is the mineral most likely to be lacking in hog rations. The common grains are low in it. Dairy by-products, tankage, fish meal, and alfalfa hay and meal have much more of it than grains do. But even if you feed one or more of these, you should also feed either alfalfa pasture or one of the salt mixtures given on the next page, to be sure that your hogs get plenty of calcium.

Severe lack of calcium, especially in the rations of young pigs and of brood sows, may cause rickets. A hog ration that is low enough in calcium to produce rickets is likely to be low in other nutrients also; and some of the symptoms that develop may be due to lack of these other nutrients. For example, if young pigs are fed only a straight grain ration without any alfalfa pasture or salt mixtures, they will grow slowly, become nervous, stiff in their legs, and finally break down with severe rickets. Their ration is low in protein and vitamins as well as calcium, and the symptoms are due to the combination of deficiencies.

Again, a sow may have small, weak pigs at birth if, during gestation, she is fed a straight grain ration, or grain plus some protein supplement like linseed meal. The unborn pigs develop poorly because the sow's ration is low in calcium, vitamin A, possibly some of the vitamin B complex, and lacks a complete protein. If these deficiencies are continued and the sow produces two litters a year, sterility and rickets often result. Alfalfa hay has been found very beneficial in improving such diets.

If a ration is only a little low in calcium, hogs may not grow so well as if they had plenty, but may not show any definite symptoms of rickets.

If alfalfa pasture is not available, you can prevent trouble due to lack of calcium by feeding one of these three simple salt mixtures per 100 pounds of ration:

1. 1 pound oystershell flour (ground oyster shells) and ½ pound common salt.
2. 1 pound finely ground limestone and ½ pound common salt.
3. 1 pound oystershell flour, ½ pound common salt, and 1 pound finely ground bone meal or spent bone black.

(One pound of ground limestone or oystershell flour supplies all the calcium needed for pigs. If 7 per cent or more of a balanced ration is made of meat and bone scraps [50 per cent protein], ground limestone or oystershell flour may be omitted. If 4 to 6 per cent of meat and bone scraps is fed in a balanced ration, only ½ per cent of ground limestone or oystershell flour need be added.)

These mixtures can be fed to growing and fattening pigs, brood sows, or boars. They can be fed separately in small boxes in the lots where all the animals can get to them. Or they can be mixed with the feed. The amounts given are enough to mix with 100 pounds of feed.

You do not need a complex mixture. When a ration is fed which is well balanced in other respects, it is usually necessary only to add a simple mixture such as those listed above. Any one of the mixtures improves almost all hog rations. In feeding tests at the California Experiment Station, one lot of hogs gained 85 pounds more per head than a second lot over a 20-week feeding period; yet the only difference in their rations was 1 per cent of a calcium supplement.

Sunlight helps hogs make better use of the calcium in their ration. This was shown by a feeding test at the California Experiment Station, in which pigs were fed nothing but rolled barley and common salt, with and without sunlight. Those without sunlight always developed rickets first. If you cannot give your hogs direct sunlight, you can give vitamin D in their ration (see page 20) and get similar results.

Phosphorus,

while necessary for normal growth, is not required to the same extent as is calcium. In a 100-pound pig, for example, there is about ½ pound of phosphorus and ¾ pound of calcium. The amount of phosphorus in the ordinary ration is generally sufficient, and this mineral need not be included in a salt mixture added to the ration. If additional phosphorus should be necessary, use mixture 3, above. The bone meal or spent bone black contains phosphorus as well as calcium.

The ratio of calcium to phosphorus

in the ration should probably be somewhere near what it is in the hog's body. The ordinary ration, with calcium added in a salt mixture, should give you a satisfactory calcium-phosphorus ratio. A ration of 85 pounds of rolled barley, 10 pounds of chopped alfalfa hay, and 5 pounds of tankage, for example, contains 0.34 pound of calcium and 0.45 pound of phosphorus. The calcium content is a little low. If you add 1 pound of ground limestone, which contains 0.40 pound of calcium, the ration then would have 0.74

pound of calcium and 0.45 pound of phosphorus. This calcium-phosphorus ratio is about right for all classes of hogs—for growing and fattening pigs, and for pregnant and lactating sows.

Common salt (sodium chloride),

you will notice, is included in all salt or mineral mixtures. This is added because it makes the ration taste better, stimulates the digestive system, and supplies essential sodium. If no other salts are needed, you may add common salt alone. The best way is to add it to your feed at the rate of ½ pound per 100 pounds.

Other salts,

such as potassium, are also needed for normal growth of hogs. But any ordinary hog ration will supply plenty of these, and you do not need to add them in a salt mixture.

Certain of these other salts may have to be supplied when suckling pigs are kept on a concrete floor and do not have access to pasture. The sow's milk does not supply all the necessary iron and copper. But these minerals are not added to the salt mixture. Ways of supplying them are discussed on page 34.

5. Vitamins and Other Supplements

Vitamin A deficiency

is likely to develop if barley or grain sorghums are your main feeds and if you feed no alfalfa hay or green feed. Lack of vitamin A sometimes causes pneumonia, reproductive troubles, night blindness, watery eyes, and harshness of hair, and may stop growth.

To protect pigs from vitamin A deficiency, provide access to green feed or give them from 5 to 10 per cent of leafy, green alfalfa hay.

If you cannot furnish green feed or alfalfa or other legume hay, 1 teaspoon of cod-liver oil per week will protect young growing pigs from any shortage of vitamin A. It can be given by mouth, mixed with the feed, or simply poured over it.

Deficiency of vitamin B complex

can cause extremely slow growth, loss of appetite, dry, curly hair, loss of muscular control, and often death, according to findings at the California Experiment Station.

There are several vitamins in the B group. Riboflavin is found in dairy products and green grass. Thiamin comes from the outer covering of grain—such feeds as wheat bran and wheat-flour middlings. Nicotinic acid is found in the leaves of plants. Good sources of pantothenic acid and pyridoxine are rice bran, cane molasses, dried skim milk, peanut meal, wheat bran, and alfalfa meal.

Vitamin D deficiency,

or rickets, might develop if pigs have no direct sunlight. It would show up as lameness, stiffness, or swollen joints. You can remedy this by giving pigs free access to direct sunlight, or by feeding them chopped, sun-cured alfalfa hay. In cases of marked deficiency, cod-liver oil has helped greatly. One lot of pigs, fed equal parts of rolled barley and rice polish for 13 months, gained only 65 pounds during that time—from 90 pounds to 155. Then their ration was changed to 99 per cent rolled barley, 1 per cent salt, and cod-liver oil. In the next 12 months, they more than doubled their weight, from 155 pounds to 320—a gain of 165 pounds with cod-liver oil.

Other vitamins

are either not needed by pigs or are needed in such small quantities that any balanced ration would contain enough.

This pig is suffering from rickets caused by lack of calcium and vitamin D in its diet.

Antibiotics,

as components of the diet, have received much attention in recent years. A number have been tested, such as aureomycin, bacitracin, penicillin, terramycin, and others, as well as some of their derivatives. Work at a number of experiment stations has shown that responses of up to 20 per cent in growth and up to 10 per cent in feed utilization can be obtained with antibiotics. The average responses, however, are considerably below these figures, and the greatest are usually in young, growing pigs. Poor, or runt pigs often give greater responses, also.

Under some conditions, there has been no effect from the addition of antibiotics. The reason for the differences in response is not known. Certain microbiological organisms live in the intestinal tract, and some of them are apparently unfavorable to the host animal. It is believed that antibiotics act upon these unfavorable organisms and reduce their numbers. This theory has not been definitely proved.

The character of the ration also influences the effect of antibiotics, with greater responses often obtained on poor rations. However, on the basis of experimental work, the use of poorly balanced rations plus antibiotics cannot be recommended. There is no reason why antibiotics should not be used on a trial basis, with continued feeding where results justify it, but they should not be used as a substitute for an adequate ration.

A number of supplements containing antibiotics are on the market. The antibiotic activity varies, and depends on the particular commercial product. The supplements are added on the basis of their antibiotic content. Usually, 20 to 50 grams of antibiotic per ton of ration is recommended per crop feeding, while 5 to 20 grams per ton is recommended from weaning until market age. Manufacturers' instructions for use of these products should be carefully followed.

Antibiotic pellets are available for implanting under the skin of the necks of baby pigs 3 to 5 days old—while they are still too young to eat mixed feed. One early report stated that this practice increased weaning weights, but latest information from the California and Illinois experiment stations shows no response.

Some arsonic acid derivatives have been found to give results similar to

those produced by antibiotics. Little information is available on these but since they are toxic, they should probably be used with caution, if at all.

The materials discussed here cannot be considered as nutrients in the same way as are protein, minerals, and vitamins. They are mainly substances which produce certain responses, as outlined above, when added to the ration.

Feeding and Feed Preparation

Hogs are fed in several ways. You may choose or combine feeding methods to suit your own conditions. Sometimes, for example, you may hand-feed one concentrate and self-feed another; or you may self-feed grains to hogs on pasture.

Self-feeding

is the method most often used to give grains and other concentrates or supplements to fattening hogs. In self-feeding, you put the feed in a self-feeder and let the hogs feed at will until they clean it

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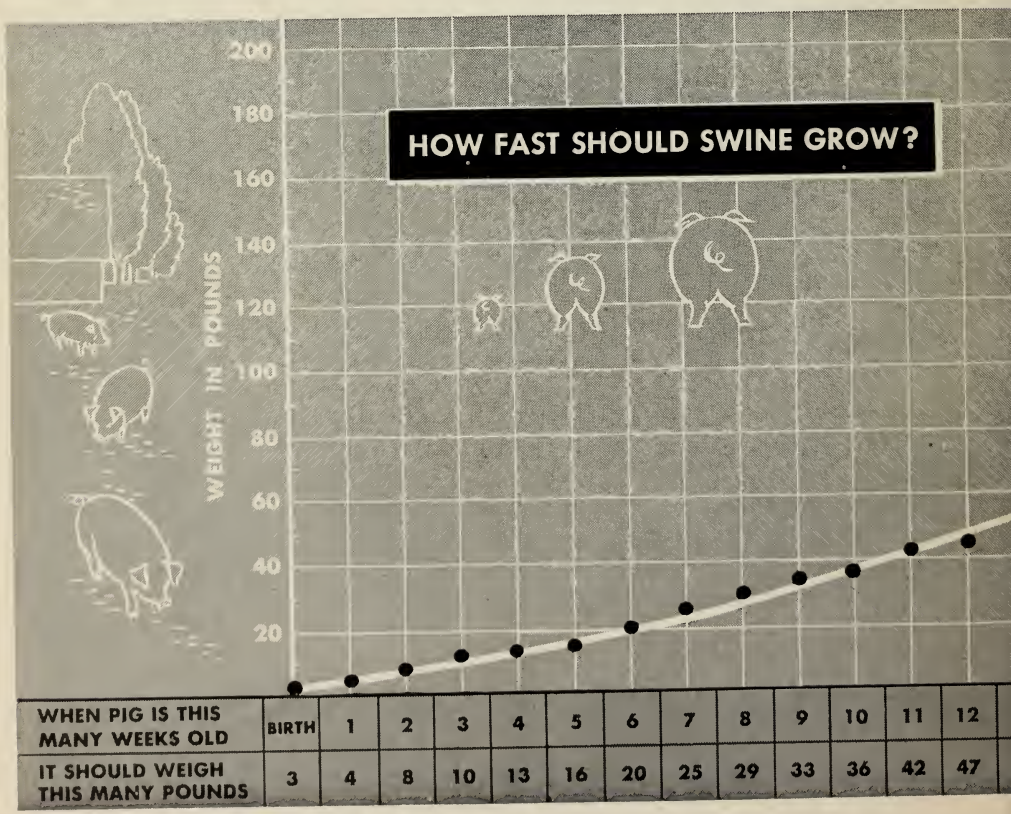
The growth curve below shows how fast animals in the University of California herd grow. It applies both to breeding and fattening hogs under average conditions. Figures at the bottom show average weight for each week.

Many conditions affect the growth rate of swine. But you can compare the growth rate in your own herd with this chart, and thus measure your own feeding efficiency under your own conditions.

Breeding animals usually average around 400 pounds at 12 months of age. Mature sows should weigh at least 500 pounds and boars 600 pounds or more in breeding condition.



WHEN PIG IS THIS MANY WEEKS OLD	BIRTH	1	2	3	4	5	6	7	8	9	10	11	12
IT SHOULD WEIGH THIS MANY POUNDS	3	4	8	10	13	16	20	25	29	33	36	42	47

up. If you are using two or more feeds, you can put each one out separately and let the hogs make their own mixture. Or you can mix the feeds in the proportion you want the hogs to have and self-feed the mixture. You may find the second way better if you want to get the hogs to take more of some feed they do not like very well. A good self-feeder is shown on page 7. Garbage plants usually self-feed the garbage on concrete floors; the figure on page 44 shows such equipment.

Hand-feeding

is used when you want to limit the feed to keep hogs from getting too fat, or for brood sows before and just after farrowing, or for herd boars between breeding seasons. In hand-feeding you weigh or measure out the amount you want the hog to have. If two or more feeds are used, they are usually mixed first.

Gleaning

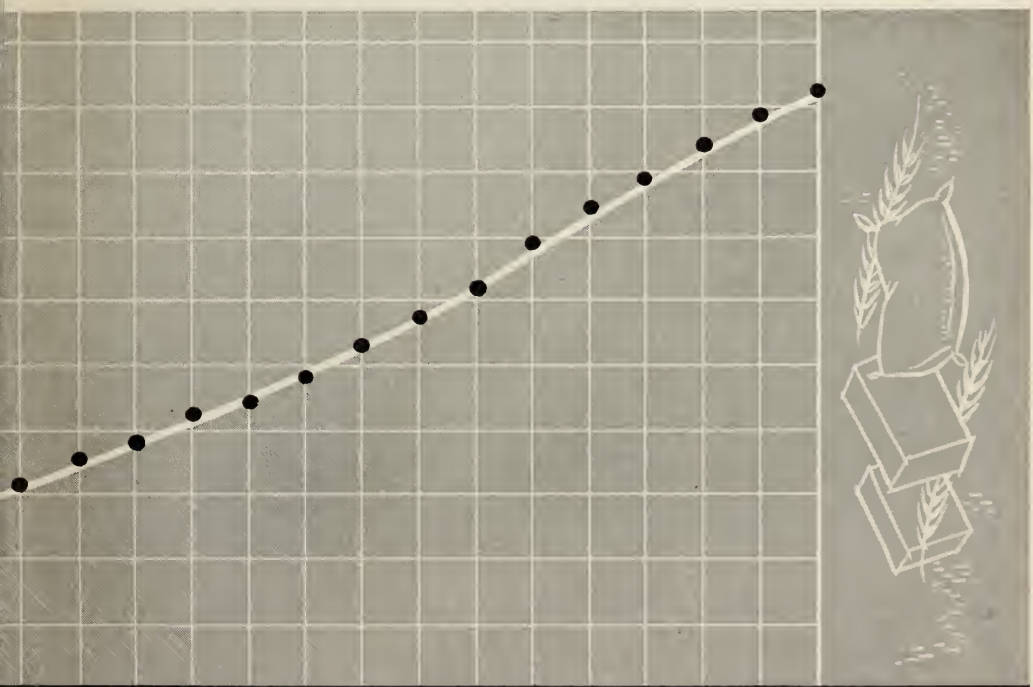
is a good way to fatten hogs weighing 100 pounds or more. Hogs are turned out to clean up waste grain in barley, rice, wheat, or other stubble after harvest. You may feed the stubble alone, or supplement it with alfalfa pasture or a protein concentrate. Further information is given on page 43.

Hogging-down

is a labor-saving way of fattening, and can be used with hogs weighing 85 pounds or more. Hogs are turned into the fields to harvest their own feed—a method now being used by many farmers for harvesting milo or milo and cowpeas. (See also page 39.)

Pasturing

is good for all classes of hogs, but is especially valuable for the breeding herd



14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	AGE IN WEEKS
61	69	75	82	89	96	106	114	122	136	148	157	167	176	183	WEIGHT IN POUNDS

and young pigs. When pasture is available, this is the best way to feed alfalfa and other forage crops. Hogs get sunlight and exercise in addition to an excellent feed.

Cooking grains or forage

does not increase food value and, in fact, probably decreases it. Cooked corn, barley, wheat, oats, and grain sorghums have a feeding value about 10 per cent lower than uncooked.

Cooking whole potatoes or beans,

on the other hand, increases their value for hogs. Potatoes can also be prepared by drying at a temperature of 145° and grinding into a meal (see page 13). Dry heating is not satisfactory for beans; but steaming, drying, and grinding into a meal is just as good a method as cooking, and it usually takes less labor in the long run. Raw beans have a bitter taste, and hogs do not eat them well.

Grinding, rolling, or crushing

is advisable for barley, wheat, and grain sorghums. If you cannot do this, feed these grains soaked.

Chopping or grinding alfalfa hay

usually pays; hogs make better use of it than of whole alfalfa hay. Do not grind feeds so fine that they are dusty.

A pipe runs down through the center of this homemade steamer, and carries steam into the bottom of the tank. Pipe is unscrewed and turned aside when steamer is tilted to empty.

MANAGING the BREEDING HERD includes feeding and care of boars, sows, and young pigs; ear notching; and keeping records.

A boar should be fed carefully,

especially during the breeding season when his condition must be maintained during heavy service. At this time he should be fed a high-energy ration with plenty of protein, vitamins, and minerals. If he has green pasture, a ration that will meet his needs is a mixture of rolled barley and tankage in the ratio of 9 to 1. Or you can use a mixture of 7 parts rolled barley, 2 parts wheat middlings, and 1 part tankage.

The amount of feed depends on the boar's condition and the intensity of the breeding season. If he is working to full capacity, it is not too much to feed him all he will clean up twice daily.

After the breeding season is over,

reduce the boar's daily ration and slowly change it to one with more carbohydrates and less protein. If he has lost weight, let him regain at least medium condition before reducing his ration.

The boar lot is usually located apart from the rest of the herd. A quiet place, accessible to forage and large enough for plenty of exercise is desirable. Clean, dry, well-ventilated quarters, with shade in summer, are necessary.

Boars often become nervous, restless, irritable, and refuse to eat. Generally this condition can be overcome by placing a barrow or bred sow with them.

There are two breeding methods:

hand, or individual, mating, which is the better, and promiscuous mating, where the boar is allowed to run with the sows.

With hand mating, a mature, vigorous boar can serve about 30 sows during the active breeding season. The best practice is for him to serve one sow a day. He may be mated to two sows a day, if one is bred in the morning and the other in the evening, and if he has a day of rest occasionally.

When the sow is in heat, she may be brought to the boar or the boar may be driven to her pen. Not over two services should be permitted, for this is enough to insure pregnancy if both are normal. After the sow is bred, it is good practice to separate her from the open sows. Also, write down her number and the date of mating on her breeding record.

When either boar or sow is overly large you can use a breeding crate.

A young boar

is fed and managed much like a mature animal. For best growth, a young boar needs a ration high in protein with plenty of calcium and phosphorus. Rolled barley, alone or with wheat middlings, supplemented with skim milk, buttermilk, tankage, or fish meal, will provide energy and growth-promoting nutrients. In addition, he should have access to alfalfa pasture, where he can also exercise naturally, and free access to a salt mixture (page 19). A good ration is given on page 36.

A young boar should be kept in a lot away from the sow herd, especially during the breeding season. An animal 8 to 9 months old may be used on a few sows without retardment of his growth. A day or two of rest between services is advisable.

The brood sow

should produce two litters a year, with proper management, one in spring and another in fall. Some garbage-feeding plants prefer to leave the pigs with the sows for about 12 weeks and thus plan to have each sow produce three litters every two years. Most of these plants distribute the breeding of their sows so that litters are farrowed every month of the year, instead of just in spring and fall.

Spring litters are usually farrowed on or after March 1. However, if pigs are born in February, they do very well in most sections of the state if weather is normal. Sows should farrow before May 1, because after that date hot weather and flies often slow the growth of young pigs.

Fall litters are usually born on or after September 1. It is best not to have sows farrow during winter months because too many baby pigs die in cold, wet weather. Also it is much harder to keep suckling pigs in a thrifty, vigorous condition during winter.

Breeding for spring litters should begin about November 10, and for fall litters about May 10 in order to farrow pigs in March and September.

Swine, like cattle, may become infected with brucellosis (infectious abortion). When this happens, they do not reproduce naturally. If at all possible, avoid this disease. (More details are given on page 48.)

The time to breed a gilt

depends more on her growth than on her age. She should be mature enough so that the demands of her growing litter and their later suckling period will not greatly affect her own development. In general, it is all right to breed a gilt to farrow at 12 months of age. If you want size in the mature sow, let her rest one season after she farrows her first litter.

Another method for obtaining large-sized sows is to breed them to farrow at 18 months of age. By that time, a gilt is practically full-grown, and she should produce regularly every 6 months thereafter.

As a general rule, gilts farrow fewer and smaller pigs than do mature sows.

At breeding time, the sow

should be medium fat and gaining ½ to 1 pound daily. For best results in getting sows into this active breeding condition, put them on good pasture, preferably alfalfa, or one of the recommended permanent pastures, and feed them enough concentrates to give the desired gain. A good mixture is 12 pounds of barley to 1 pound of tankage, plus a suitable salt mixture (one of those given on page 19).

The sow's condition largely accounts for the size of her litter and vigor of her pigs at birth, provided the boar is normal and vigorous at time of service. A sow that is too fat or very thin may not come in heat. Such a sow, if she accepts the boar, may fail to conceive, or her litter often will be small.

Sows usually come in heat 3 to 5 days after weaning the pigs. The period of heat lasts about 3 days and occurs every 20 to 21 days. Only during this time will the normal sow accept the boar.

Time from breeding to farrowing

averages 114 days, but may vary from 112 to 116 days. By keeping an accurate breeding record, you can figure the farrowing date closely. It is highly important to know this date so that you can take extra good care of the sow during the week before farrowing. Table 3 will help you to figure farrowing dates.

In feeding a bred sow,

try to give her enough nourishment for her developing litter, but not so much that she will be too fat at farrowing time. This condition results in poorly developed pigs and difficult farrowing. She will need very little grain during the first 12 weeks after she is bred if she has good

Table 3.—When Should a Sow Farrow?

If sow was bred	She will farrow	If sow was bred	She will farrow	If sow was bred	She will farrow
Jan. 1	April 24	May 6	Aug. 27	Sept. 3	Dec. 25
Jan. 6	April 29	May 11	Sept. 1	Sept. 8	Dec. 30
Jan. 11	May 4	May 16	Sept. 6	Sept. 13	Jan. 4
Jan. 16	May 9	May 21	Sept. 11	Sept. 18	Jan. 9
Jan. 21	May 14	May 26	Sept. 16	Sept. 23	Jan. 14
Jan. 26	May 19	May 31	Sept. 21	Sept. 28	Jan. 19
Jan. 31	May 24	June 5	Sept. 26	Oct. 3	Jan. 24
Feb. 5	May 29	June 10	Oct. 1	Oct. 8	Jan. 29
Feb. 10	June 3	June 15	Oct. 6	Oct. 13	Feb. 3
Feb. 15	June 8	June 20	Oct. 11	Oct. 18	Feb. 8
Feb. 20	June 13	June 25	Oct. 16	Oct. 23	Feb. 13
Feb. 25	June 18	June 30	Oct. 21	Oct. 28	Feb. 18
Mar. 2	June 23	July 5	Oct. 26	Nov. 2	Feb. 23
Mar. 7	June 28	July 10	Oct. 31	Nov. 7	Feb. 28
Mar. 12	July 3	July 15	Nov. 5	Nov. 12	Mar. 5
Mar. 17	July 8	July 20	Nov. 10	Nov. 17	Mar. 10
Mar. 22	July 13	July 25	Nov. 15	Nov. 22	Mar. 15
Mar. 27	July 18	July 30	Nov. 20	Nov. 27	Mar. 20
April 1	July 23	Aug. 4	Nov. 25	Dec. 2	Mar. 25
April 6	July 28	Aug. 9	Nov. 30	Dec. 7	Mar. 30
April 11	Aug. 2	Aug. 14	Dec. 5	Dec. 12	April 4
April 16	Aug. 7	Aug. 19	Dec. 10	Dec. 17	April 9
April 21	Aug. 12	Aug. 24	Dec. 15	Dec. 22	April 14
April 26	Aug. 17	Aug. 29	Dec. 20	Dec. 27	April 19
May 1	Aug. 22	.....	.....	.....	.....

pasture, plenty of fresh, clean water, and shade—and if it is summertime.

During her last month of pregnancy, she will need a heavier ration, because 75 per cent of the growth of her litter takes place during this period. The bodies of the unborn pigs consist mostly of protein, minerals, and water; hence you must be sure to feed plenty of protein supplements and mineral mixture during the last month.

If the sow does not get enough nutrients in her feed at this time, the growing fetus will take them from her body. Then she will farrow and begin nourishing her pigs in a somewhat weakened condition. As a result, her litter will not get enough milk, and there will be a large share of weak, unthrifty pigs and some dead ones. Every pig farrowed dead, or which dies while young, costs at least 140 pounds of wasted feed. That is why it is important to give sows good care before they farrow.

For short periods during winter months when you have no pasture, feed plenty of concentrates, such as barley, milo, or corn, supplemented with skim milk or tankage. You can substitute leafy alfalfa hay for alfalfa pasture, and feed it in racks, scattered on feeding platforms, or chopped and mixed with grain. Although alfalfa hay is bulky, it should make up 10 to 25 per cent of the ration when there is no alfalfa pasture. Roots and tubers provide succulence.

HERE ARE SOME SUGGESTED RATIONS FOR SOWS BEFORE FARROWING

DURING FIRST 12 WEEKS AFTER BREEDING

ON PASTURE

	Lbs. feed per 100 lbs. mix
Barley or other grains	90
Soybean meal	4
Meat and bone scraps (50% protein)	5
Oystershell flour	½
Common salt	½

IN DRY LOT

	Lbs. feed per 100 lbs. mix
Barley or other grains	74½
Alfalfa meal	15
Soybean meal	4
Meat and bone scraps (50% protein)	6
Common salt	½

Gilts or mature sows, bred at normal weights, should be fed at an approximate rate of 2 per cent of their body weight per day, which will allow them to gain ½ to 1 pound a day. If a gilt is small at breeding, she should receive 3 per cent of her body weight daily until she reaches a normal weight, after which she should receive 2 per cent.

FROM 12TH TO 15TH WEEK

ON PASTURE

	Lbs. feed per 100 lbs. mix
Barley or other grains	76½
Alfalfa meal	10
Soybean meal	7
Meat and bone scraps (50% protein)	6
Common salt	½

IN DRY LOT

	Lbs. feed per 100 lbs. mix
Barley or other grains	67½
Alfalfa meal	15
Soybean meal	9
Meat and bone scraps (50% protein)	8
Common salt	½

Feed this ration daily at about 2 per cent of the sow's body weight.

DURING LAST 10 DAYS BEFORE FARROWING

ON PASTURE OR IN DRY LOT

	Lbs. feed per 100 lbs. mix
Barley or other grains	42
Alfalfa meal	25
Soybean meal	7
Wheat bran	25
Oystershell flour	½
Common salt	½

Housing is more of a problem in winter than in summer. Just before they farrow, sows too often have poor shelter or are turned into barns or sheds with other livestock. This is poor practice. It is much better to have clean, warm, well-bedded sleeping quarters with enough ventilation and plenty of room outside for exercise.

Good management at farrowing can easily mean the difference between profit and loss. You work just as hard and use almost as much feed for a sow with only 4 pigs as for one with 8. You can overcome most losses at farrowing time by proper feeding and management.

You will find it beneficial to reduce the ration 30 to 50 per cent at farrowing time. During the week before farrowing, 25 or 30 per cent wheat bran added to the ration tones up the system, prevents constipation, and makes for normal birth of pigs.

Scrub the floor and walls of the farrowing pen with a scalding lye solution (1 pound of lye to 30 gallons of water) and thoroughly disinfect the pen. If it is dry, airy, well-lighted, and free from drafts, you will raise more pigs.

If you place the sow in the farrowing pen about 4 days before her pigs are due, she can get used to her new surroundings and to the herdsman. Wash

her thoroughly with soap and warm water before bringing her into the farrowing pen, and disinfect her with a mild germicide such as Lysol or other coal-tar preparations. You can do this with a pressure sprayer or with a common sprinkling can.

Use clean bedding free from dust. Straw, hay cut in 6-inch lengths, or wood shavings make good bedding. Avoid too much of it, because baby pigs may get tangled and be crushed by the sow. Use enough bedding to keep the sow clean and warm. All bedding should be removed at least once a week and replaced with clean material. Manure should be removed daily.

As farrowing time approaches, the sow becomes restless, gathers bedding, and makes a nest for her litter. The vagina becomes swollen, and milk comes into her udder 12 to 24 hours before farrowing. One light feed of bran as a thin slop, plus fresh, clean water, will be enough during the 24 hours before her pigs are born.

Sows ordinarily have little difficulty in farrowing on their second and later litters if they have been handled properly during pregnancy.

However, a gilt sometimes has trouble bearing her first litter. She demands close attention. If continued labor does not seem to help, give her aid. The unskilled use of forceps usually kills the pigs and often injures the sow's reproductive organs. It is generally best to use just a well-greased hand and arm, clean and disinfected. Pigs that are not presented head first should be forced back and turned so as to make delivery possible. If the sow is having extreme trouble delivering her litter, get a competent veterinarian quickly.

As each pig is born,

remove the membrane from the nose and mouth, and wipe the body dry. As soon as they have gained a little strength, newborn pigs should be allowed to suckle. If a pig is weak or cannot suckle, you can probably get him to nurse by stripping a little milk into his mouth. If you can make him swallow, he will soon gain strength and manage by himself.

If the pigs get chilled, you can generally revive them in a warm box, or in direct sunlight, or by rubbing them vigorously between your hands. Often a pig looks dead when born, but you can sometimes start his breathing by removing the mucus covering his mouth and nose, and gently slapping his side.

If a sow is nervous or irritable when giving birth to her litter, let the pigs suckle and then put them in a warm farrowing box lined with straw and lightly covered to keep in the heat. When farrowing takes a long time, it is good practice to return the pigs to the sow every hour or two and let them suckle. If some small, weak pigs are born in a litter of strong pigs, take the stronger ones away now and then to give the weaker ones a chance to nurse.

Occasionally a sow will farrow more pigs than she can properly nourish. When this happens, give some of them to another sow that has recently farrowed a small litter. When sows do not provide milk at farrowing time, you can often start the milk flow by applying hot packs to the udder and by vigorous massage.

The sow should be disturbed as little as possible while farrowing. Only the attendant should enter the pen at this time.

When it appears, the afterbirth should be removed with a long-handled shovel or manure fork, and buried or burned. If it is left in the pen, the sow generally will eat it.

You cannot watch sows too closely

during all the farrowing season. You will save many pigs by inspecting the litter every 2 or 3 hours, because some newborn pigs may wander away, become chilled, or be unable to suckle.

It is usually recommended that pigs be left with the sow until they are 7 to 10 days old. If this is not possible, it is considered good practice to leave them with the sow until they are at least 48 hours old.

The time from birth to weaning is the most critical in a pig's life. Good care then is sure to pay good profits later on in more live pigs per litter, healthier pigs, and faster gains.

Normal sows will not eat their pigs

if fed properly during pregnancy. It is commonly believed that rations low in protein and minerals, if fed during the last two months before farrowing, may help cause this habit. In some cases you may be able to remedy the situation by feeding tankage, meat meal, or fish meal after farrowing. If a sow has formed the pig-eating habit, fatten and market her.

An electric brooder

(see illustration below) will help to save a larger share of the pigs farrowed. It may be used at any time except during the hot summer months. The pigs themselves are the best guide as to how long to keep it going. As long as they crawl under it for warmth, it will pay you to leave it on. If you have a central farrowing house, you can arrange the brooders as shown in the picture on page 5. This makes it easy to take the pigs out for marking and other operations.

"Wolf" or "black" teeth

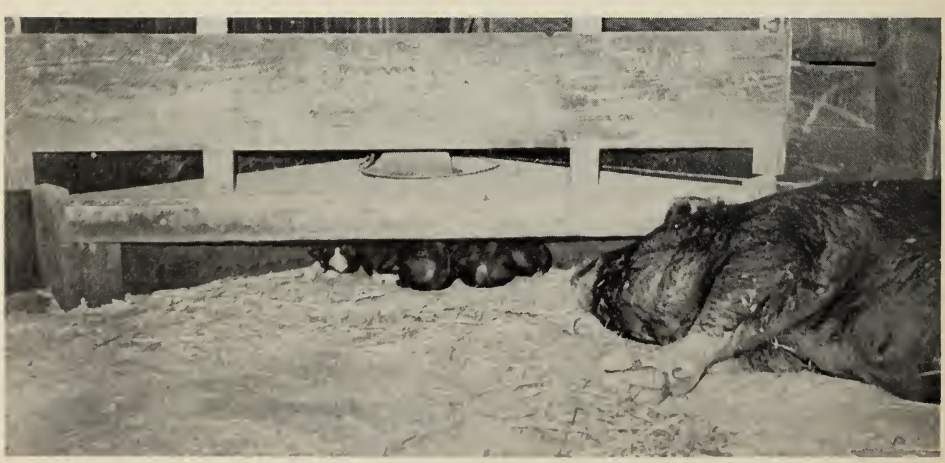
are eight needlelike teeth in the upper and lower jaws of a young pig. They seem to be useless. They should be removed about a day after farrowing by carefully cutting them with small diagonal pliers, as shown in the illustration.

If not removed, they are likely to cause trouble. Pigs bite each other while nursing, and this often results in cuts around the mouth that become infected. The pigs also bite the sow, and she jumps and sometimes injures or kills some of her litter.

Pigs should be marked

when they are a few days old, with either an individual number or a litter number—that is, the same number for every pig in one litter. This identification will tell you the number of pigs raised by each sow, so that you can pick out the unproductive sows and fatten them. You can also choose breeding stock of known parentage.

Leave the electric brooder on as long as the baby pigs continue to use it.

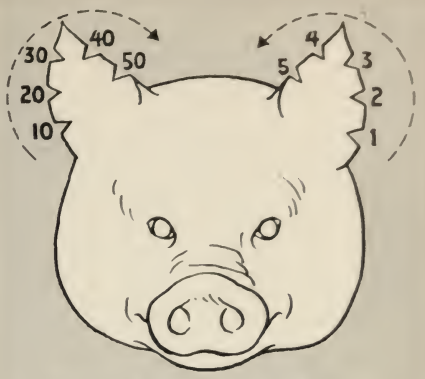


For identification, some growers have tried metal tags in the pig's ear, but this system does not work out too well and is not recommended. Metal tags usually tear out, no matter how carefully you put them in, and a tag in each ear is just so much extra trouble. Besides, tags do not work very well on small pigs because their ears are too small, and in any case the numbers are hard to read.

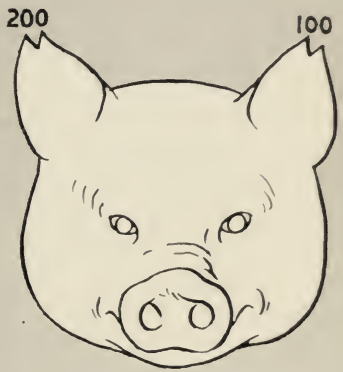
Most growers use the ear-notch system because it is easiest and best. You can mark young pigs only a few days old without injury (see illustration), and they stay marked for life. The numbers are easy to read if you make the notches large enough. Here is the system used at the University of California at Davis:

The pig's left ear is used for numbers 1 through 9, and his right ear for 10, 20, 30, and so on up to 90. If a pig was numbered 69, the 60 would show on his right ear and the 9 on his left.

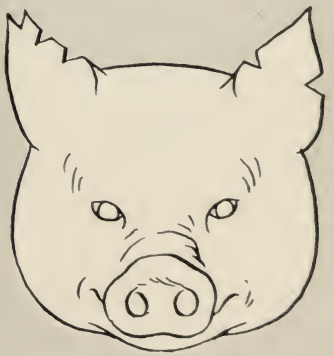
The position of the notches on the ear tells you the pig's number. There are five notches around each ear, indicating numbers 1 through 5, or 10 through 50, as shown in the drawing on this page.



Notches are numbered from outside to inside



100 and 200 are indicated by tip notches



Notches for number 297

Ear notches may be used to number litters or pigs up to number 399.

Pliers shown at right are useful in removing "wolf" teeth.

Notice that numbers 1 and 10 are always on the outside, and the numbers read around the pig's ear toward his nose.

How do you get numbers 6, 7, 8, or 9? Just put two notches in the ear and add the figures which they represent.

For instance, to show number 7, notch the number 5 and 2 spaces. Do not use the number 4 and 3 notches because they are both too near the tip of the ear, and ears notched this way tear too easily. To show number 6, use the 5 and 1 notches; for number 8, the 5 and 3 notches; for number 9, the 5 and 4 notches.

In feeding orphan pigs,

a good ration is about 1 quart of whole cow's milk per pig, at each feeding, plus mixed shelled corn or rolled barley and tankage, which can be self-fed. You can add green alfalfa meal or alfalfa leaves to this diet. For best results, give this feed five or six times daily for awhile, and gradually cut it down to three feedings. These are the recommendations based on a five-year study by Iowa Experiment Station workers.

Artificial sow milks have received much attention in recent years, and several such products are now available. These can be used for orphan pigs, or to feed pigs early in life so that the sow can be rebred sooner, or as a supplemental feed for pigs nursing a sow. The artificial milk is a dried product to which water is usually added. It may be fed in a poultry type fountain or a trough. Extreme sanitation is necessary for raising pigs in this manner, and some hog men have had only limited success with this method.

In feeding a sow after farrowing,

increase her ration slowly at first. You may or may not feed her the first 24 hours after her pigs are born, just as you choose. Practical hog men have followed both methods with good results, but a lot depends on the sow's condition. All agree, however, that sows should be fed lightly the first 3 or 4 days after their pigs are born.

A good rule to follow for the first feeding is to give 1 or 2 pounds of a suitable concentrate mixture, such as rolled barley and wheat bran, equal parts by weight. On the next day, give 2 or 3 pounds, and increase the amounts daily until you are feeding 8 or 9 pounds at the end of the first week. Under normal conditions, the sow can be on full feed in 10 to 14 days after farrowing.

Watch constantly for any digestive disturbances that show up in suckling pigs, and regulate the sow's feed accordingly. Overfeeding the sow, constipation, and lack of exercise may cause scours in pigs. If this happens, it is often helpful to reduce the sow's feed. If she is constipated, give her 5 ounces of Epsom salts in her feed.

The feed requirements of a sow suckling a litter are much the same as for a high producing dairy cow. The sow needs nutrients to maintain her body and to produce plenty of milk for her litter. To satisfy these demands, feed her a ration high in proteins, vitamins, and mineral matter, especially calcium and phosphorus. You can supply these materials with home-grown grains, supplemented with such high-protein feeds as wheat middlings and tankage. Underfeeding often makes the sow lose too much weight.

It is surprising how hard a sow works to feed her litter. Production records were kept on two sows for 10 weeks. During that time, each produced, on the average, 539 pounds of milk, which contained 100 pounds of solids, in addition to maintaining herself and increasing her weight.

Thus it is important to feed sows well after their pigs grow large enough to consume lots of milk. If you do, the pigs will grow fast and the sow will keep her own good health.

Some suggested rations for sows after farrowing are given below. Changes in rations should be gradual.

Feed the first ration carefully, not more than 2 pounds for the first 3 days, and gradually increase it up to 8 or 9 pounds on the seventh day.

DURING THE FIRST 7 DAYS

	Lbs. feed per 100 lbs. mix
Barley or other grains	62½
Alfalfa meal	15
Soybean meal	6
Wheat bran	10
Meat and bone scraps (50% protein)	6
Common salt	½

By 7 to 10 days after farrowing, the sow will be on full feed. This is as much feed as she will clean up readily twice daily in 20 to 30 minutes. From 7 to 14 days after farrowing, the ration is gradually changed so that at 10 to 14 days the sow will be on the ration which she will receive during her entire lactation period. Typical rations for sows are as follows:

FROM 14 DAYS UNTIL WEANING

ON PASTURE

	Lbs. feed per 100 lbs. mix
Barley or other grains	87
Soybean meal	7
Meat and bone scraps (50% protein)	5
Oystershell flour	½
Common salt	½

IN DRY LOT

	Lbs. feed per 100 lbs. mix
Barley or other grains	68½
Alfalfa meal	15
Soybean meal	8
Meat and bone scraps (50% protein)	8
Common salt	½

At this stage, feed the sow all she will eat. Even when on full feed, heavy-milking sows will lose 25 pounds or more during lactation. The number of pounds for a full feed varies with the sow and her litter. If you feed her a little less than she will clean up readily twice a day, she is on full feed. Her appetite is a good guide in feeding.

Put sows and pigs on clean pasture from 10 to 14 days after farrowing, weather permitting (see illustration). Forage is valuable because it helps produce milk, provides proteins and plenty of minerals and vitamins, and allows pigs lots of exercise in direct sunlight. Legume pasture, growing on recently plowed lots, is best. After you have raised hogs on a pasture for one season, you should not use the land in this way again for at least a year. If you use pasture repeatedly without such a rest, you may have trouble with roundworms or other parasites.

Your pastures should be large enough for two to four sows and their litters, and they should be tightly fenced. Clean, warm, well-bedded houses are essential. A good type of house is shown on page 4; this is big enough for two sows and litters.

You will get best results by running a few sows together. You can give the smaller pigs more attention in feeding and they will have a better chance to grow normally if they do not have to compete with larger pigs.

If you have no small pasture, you can put more sows and their litters on a large pasture, but the pigs should all be about the same size. Do not turn a sow with 2- or 3-weeks'-old pigs in with a sow whose pigs are ready to wean. This usually results in too many small, unthrifty pigs.

When pigs are 2 to 3 weeks old, they will eat a little grain. They should feed from their own self-feeder placed inside a small enclosure or "creep" so that larger animals cannot disturb them (see page 7). The common farm grains meet their demands at this age, but as the pigs grow older and eat more grain, give them some protein supplement like

Sows and their pigs should be put on clean pasture when the baby pigs are 10 to 14 days old.

skim milk, dried skim milk, middlings, tankage, fish meal, or soybean meal. A 17 per cent ration is adequate.

Skim milk plus grain is one of the best feeds for young growing pigs. Give small amounts at first and increase the amount gradually—just what they will clean up.

When baby pigs are kept on concrete or board floors longer than their first 10 days, they are likely to develop anemia. Mild cases are hard to detect, but in later stages, anemic pigs breathe hard, their skin turns pale, they grow poorly, and some of them may even die. These things happen because sow's milk, which is their only feed, does not contain enough iron and copper, and baby pigs apparently use up their own supply, which is stored in their liver, soon after birth. The best way to provide iron is to move the sow and litter to pasture when the pigs are 10 days old. They can usually get enough iron and copper from the soil. If you cannot do this, throw a shovelful of fresh, clean dirt into the pen every few days.

Wooden trough on cart holds young pig securely during castrating operation.

You can also mix 3½ ounces of iron sulfate in 5 quarts of water and give 1 teaspoon of this solution to the pigs daily. Or you can throw a little of it on the floor where the baby pigs will lick up enough of it to meet their needs. Or you can paint the sow's udder with it. The iron sulfate contains enough copper impurities to supply the pigs' needs.

Young pigs can be castrated easily and without much danger if you take proper precautions. The best time to castrate is while the pigs are from 3 to 6 weeks of age and still suckling. At this age pigs are small enough to be handled easily, which makes the operation simple. It hardly slows their growth, because

there is almost no shock to the pig. A good plan is to feed nothing but mother's milk the day before and the day after castration.

If your hands and the knife are clean and disinfected, and if you make the cuts large enough to insure good drainage, there will be less danger from infection. Afterward, sows and pigs should be placed in clean pastures or lots.

You will find castration and similar operations easier if you have a table or a cart such as that shown in the illustration on the opposite page.

Rooting can be prevented

before the pigs are weaned. If hogs are allowed to root, they may dig up the pasture. Then, too, they are more likely to get infected with parasites in the soil, especially lungworms. Placing a small ring in the cartilage of the snout is the most common method of preventing rooting. With a small pig, one man holds the pig and another inserts the ring with the ringer. Older and larger hogs can be snubbed to a post by looping a small rope around the upper jaw. Then the ring can be inserted as with smaller pigs. Rings and a ringer can be purchased at most hardware stores. It is not good practice to cut the snout to prevent rooting.

Pigs are weaned

between 7 and 9 weeks of age, under the two-litter-a-year system, which is the common one. At this age they will be eating a pretty heavy feed daily.

The best practice is to leave the pigs on the same pasture that they used while suckling, and put the sows on another pasture.

About a week before weaning, gradually reduce the sow's ration to decrease her flow of milk. This helps indirectly to avoid possible injury to her udder.

If you are feeding skim milk to pigs at weaning time, it should be gradually increased, but never feed more than they will clean up in a short time.

Keep feeding the same grain ration to pigs at this time. If you must change the feed, stretch the change over a 3- to 5-day period. Any sudden change probably will upset the pigs, and sometimes will kill them.

After the pigs are weaned,

put the sow in a separate pasture and feed her lightly until her milk flow stops. Then increase her feed, according to her condition. You should be feeding her heavily enough at breeding time so that she gains from ½ to 1 pound daily.

While caring for pigs after weaning,

select the gilts and boars that you intend to save for breeding stock and separate them from those to be fattened. As a rule, only gilts and boars out of the best type and best producing sows should be kept.

This is where the ear-notching system of identification proves useful. If you are raising a fairly large number of hogs, it is hard to pick out the stock from your best sows unless young pigs are marked.

Experiments at the University of California show that pigs can be made to gain a pound a day after weaning if they are fed right. More important, *pigs on pasture gain faster and need less concentrates per pound of gain than similar pigs in dry lot.*

The gilts saved for breeding stock,

and how they are fed and cared for, determine your future sow herd. With these animals, your aim is for as much thrifty growth as possible, not for fat. The results depend largely upon the common sense and judgment of the feeder.

To obtain good growth, put your gilts in a pasture. In most cases, best growth results from hand-feeding, especially after the animals reach about 100 pounds in weight. Their ration should include plenty of energy producing carbohydrates and large amounts of proteins, salts, and green pasture or green alfalfa meal or chopped hay. A good combina-

tion of feeds to promote a gilt's growth is alfalfa pasture plus 3 parts of skim milk or buttermilk to 1 part of grains or other carbonaceous concentrates, by weight.

Young boars saved for breeding

should be fed and managed much like the growing gilt. The two should be separated after weaning.

Here is a suggested ration for young boars and gilts in the breeding herd, weighing 175 to 250 pounds:

	Lbs. feed per 100 lbs. mix
Barley or other grains	90
Soybean meal	5
Tankage	3
Oystershell flour	1
Salt	1

Feed this ration at from 2 to 2½ per cent of the animal's body weight, plus green pasture.

The production-registry program

is one for testing and proving the efficiency of purebred swine. It has been adopted and is supervised by the various national breed associations. The litters which are tested must be purebred, and the sows and boars must be registered.

To qualify a litter for the Production Registry, a sow must raise at least 8 of her own pigs to a minimum litter weaning weight at 56 days, depending on her age. If she is over 15 months old at farrowing, the minimum litter weaning weight is 320 pounds; if she is younger than 15 months, 275 pounds. For further information write your national breed association.

Accurate breeding records

are important, whether your herd is grade or purebred. Keep them up to date. Your records for each sow should show breeding date, boar used, farrowing date, number of boars and gilts farrowed, and number of each raised. You can make up 3 × 5 inch cards showing this information.

A swine herd improvement program

for California is described in "Production Testing in Swine," a circular available from your University of California Farm Advisor.

The California program is based on the Production Registry Program of the national purebred swine associations, and differs from it in only two respects—the entire breeding herd must be tested, not merely outstanding individuals, and swine need not be purebreds.

This program not only encourages production testing of swine, but also sets up record keeping systems. Improvement will be along two lines. First, the herd production will be increased by weeding out poor animals. Second, average individual production will be increased because superior producing breeding stock can be selected.

Pigs fattened in dry lot should be fed extra protein supplement and alfalfa meal.

FATTENING PIGS for MARKET
requires grain and protein-rich legume pasture.

There are six ways of fattening hogs for market:

1. Full feeding (self-feeding) of grain on alfalfa or other pasture from weaning until marketing.
2. Feeding a limited ration (hand-feeding) on pasture.
3. Garbage feeding.
4. Full feeding (self-feeding) in dry lot.
5. Hogging-down crops.
6. Feeding barley and rice stubble.

Full feeding on forage

fattens pigs most rapidly; but local conditions will determine whether it is workable and economical.

The rations given in Table 4 were fed at the California Experiment Station, with the results shown.

Table 4.—Full Feeding on Alfalfa Pasture

Lot number and ration	Average initial weight	Average daily gain	Feed consumed for 100 pounds of gain
	pounds	pounds	pounds
1. Rolled barley, self-fed	90	1.27	Barley 434
2. Rolled barley and tankage, self-fed	90	1.34	Barley 421 Tankage 18
3. Rolled barley and coconut meal	88	1.04	Barley 299 Coconut meal 111
4. Rolled barley and wheat middlings	103	1.27	Barley 360 Wheat middlings 110
5. Ground milo and tankage, self-fed	103	1.54	Ground milo 400 Tankage 10
6. Rolled barley, 15 parts Tankage, 1 part — By weight, mixed and self-fed	83	1.66	Barley 361 Tankage 24
7. Rolled barley, 5 parts Raisins, 5 parts Rice bran, 5 parts Tankage, 1 part — By weight, mixed and self-fed	82	1.76	Barley 136 Raisins 136 Rice bran 136 Tankage 27
8. Raisins, 7½ parts Rice bran, 7½ parts Tankage, 1 part — By weight, mixed and self-fed	81	1.48	Raisins 220 Rice bran 220 Tankage 29

All data from California Agricultural Experiment Station feeding tests.

You can see that the pigs self-fed barley and tankage, or ground milo and tankage (lots 2 and 5), did not eat a great deal of tankage if they also had good alfalfa.

Those self-fed mixed barley and tankage on pasture (lot 6) made their gains on less feed than any other lot, but they gained more slowly than lot 7. They used less feed because in a given amount of barley there are more total digestible nutrients than in raisins or rice bran.

On one Tulare County hog ranch, 50 good-quality 3-month-old feeder pigs, averaging 57 pounds in weight, were put on a ration of barley, figs, yellow corn, and skim milk, with Sudangrass pasture. They gained 1.7 pounds a day and consumed 315 pounds of concentrates and 680 pounds of skim milk (377 pounds of feed on a dry basis) per 100 pounds of gain. Thirty of these hogs shown at the State Fair placed second. Their carcasses graded Good to Choice hard hogs, and the dressing percentage was 78—unusually high.

There is simply no substitute for protein-rich pasture for growing pigs. They seem healthier and thriftier than if kept in cramped quarters. Pigs on legume pasture need less protein supplements than those in dry lot.

Table 5 gives some suggested rations for different weights of hogs on pasture.

With limited grain and pasture, it is good practice to feed 1 or 2 pounds of concentrates for each 100 pounds of live weight. You can use cull fruits, vegetables, and grapes under this scheme.

At the California Experiment Station, 31 pigs were rotated between two ½-acre plots of alfalfa from June to November. They also were fed a limited ration of 1 part rolled barley to 3 parts skim milk by weight. The aim was a 1-pound daily gain per pig, using as much alfalfa pasture and as little grain mixture as possible. The pigs gained 0.9 pound per head and required 275 pounds of barley and 825 pounds of skim milk for 100 pounds of gain.

Pigs may be fattened in dry lot if you have little or no pasture. But you will need to feed more protein supplements, such as dairy by-products, tankage, fish meal, linseed meal, soybean meal, and wheat middlings, than if your pigs were on pasture. This must be done to insure proper growth.

You can put pigs in dry lot (see photo, page 36) soon after weaning, when they weigh from 45 to 75 pounds. They should have plenty of shade and clean water and a suitable salt mixture. Their quarters should be kept clean.

Growing and fattening pigs need vitamin A. Pigs in dry lot may develop a deficiency in about 45 days on most rations. To avoid this, add alfalfa hay or meal, or some other vitamin-A carrier to the ration.

A young pig uses almost all his feed for maintenance and growth. Besides providing energy, his ration should contain nutrients to build muscle and bones. The common farm grains do not furnish enough of these materials for fast growth, so protein-rich feeds are needed as supplements.

There are two advantages to adding a protein supplement to barley or corn in dry-lot rations. First, pigs fatten faster; and second, they need less feed for 100 pounds of gain. Pigs make excellent, economical gains when fed barley and tankage, barley and skim milk, or ground milo and skim milk, as shown in Table 6. Barley and corn are about equal when supplemented with either tankage or skim milk.

As the pigs grow older and the weight increases, gradually cut down the amount of protein supplements and substitute more grains or other carbonaceous feeds. Table 5 suggests some rations for different weights of hogs on pasture and in dry lot.

Table 5.—Suggested Rations for Fattening Pigs on Pasture and in Dry Lot

Weight of pigs	Expected daily gain	Rate of feeding	Crude protein level of ration	Ingredient	Pounds per 100 pounds mix	
					Green pasture	In dry lot
pounds	pounds	per cent body wt.	per cent		pounds	pounds
40–74	0.90	5½	16	Barley or other grain	84½	72
				Alfalfa meal	....	10
				Soybean meal	8	10
				Meat and bone scraps (50 per cent protein)	7	7½
				Oystershell flour	....	....
				Common salt	½	½
75–124	1.50	5	14	Barley or other grain	89	76½
				Alfalfa meal	....	10
				Soybean meal	5	7
				Meat and bone scraps (50 per cent protein)	5	6
				Oystershell flour	½	....
				Common salt	½	½
125–174	1.75	4½	13	Barley or other grain	91½	81
				Alfalfa meal	....	7
				Soybean meal	4	7
				Meat and bone scraps (50 per cent protein)	3	4
				Oystershell flour	1	½
				Common salt	½	½
175–225	1.80	4	12	Barley or other grain	95	85½
				Alfalfa meal	....	5
				Soybean meal	....	4
				Meat and bone scraps (50 per cent protein)	3½	4
				Oystershell flour	1	1
				Common salt	½	½

More nutrients, succulence, and variety may be added to dry-lot rations by feeding roots, tubers, pumpkins, or alfalfa hay occasionally.

Table 6 summarizes dry-lot feeding trials with various combinations of the more common feeds.

Hogging-down

has been successful in tests at this station (see photos, p. 43). Hogs do at least as well when they harvest the crop themselves as when hand- or self-fed in the feed lot. You will get faster and cheaper gains during hogging-down if you feed a protein supplement or legume forage.

In some places, barley is hogged-down, but this practice has not yet been tested experimentally. Producers have found, however, that a fairly small area should be hogged-down at one time, that water should be close at hand, and that there should be either natural or artificial shade.

Table 6.—Fattening Pigs in Dry Lot

Lot no.	Ration used	Feed used per 100 pounds of gain, pounds	Number of trials	Average initial weight, pounds	Average daily gain, pounds
	Self-fed, each feed in separate self-feeder, mineral mixture self-fed in addition				
1	Rolled barley	546	3	74	0.7
2	Rolled barley	420	1	86	1.5
	Tankage	42			
3	Rolled barley	252	2	65	1.2
	Raisins	166			
	Tankage (45 per cent protein in one trial)	75			
4	Rolled barley	270	2	110	1.9
	Rice polish	121			
	Tankage	25			
5	Rolled barley	465	35	88	0.9
	Alfalfa meal (in racks)	38			
6	Corn	544	35	118	1.0
7	Corn	436	1	118	1.5
	Protein supplement				
8	Corn	288	10	60	1.3
	Skim milk or buttermilk	567			
9	Rough rice, finely ground	461	2	80	1.4
	Tankage	56			
10	Ground milo	289	1	73	1.6
	Skim milk	896			
11	Ground milo	349	1	73	1.3
	Whey	1,346			
	Tankage self-fed in separate self-feeder, other feeds mixed and self-fed; mineral mixture self-fed in addition				
12	Rolled barley, 50 parts	183	1	57	1.4
	Rice polish, 50 parts	183			
	Tankage	33			
13	Rolled barley, 50 parts	202	1	56	1.3
	Rice bran, 50 parts	202			
	Tankage	54			
14	Rolled barley, 33⅓ parts	161	1	57	1.1
	Raisins, 33⅓ parts	161			
	Rice bran, 33⅓ parts	161			
	Tankage	31			

Table 6—(Continued)

Lot no.	Ration used	Feed used per 100 pounds of gain, pounds	Number of trials	Average initial weight, pounds	Average daily gain, pounds
	Mixed and self-fed, mineral mixture self-fed in addition				
15	Rolled barley, 25 parts	261	2	48	1.6
	Skim milk, 75 parts	783			
16	Rolled barley, 25 parts	331	1	54	1.4
	Whey, 75 parts	993			
17	Rolled barley, 12½ parts	156	1	55	1.5
	Raisins, 12½ parts	156			
	Skim milk, 75 parts	936			
	Mixed and hand-fed twice daily				
18	Rolled barley, 78 parts	392	1	60	0.9
	Alfalfa hay (chopped), 20 parts	99			
	Salt, 1 part	5			
	Oystershell flour, 1 part	5			
19	Rolled barley, 85½ parts	348	2	57	1.1
	Tankage, 7½ parts	31			
	Alfalfa meal, 5 parts	20			
	Salt, 1 part	4			
	Oystershell flour, 1 part	4			
20	Rolled barley, 83 parts	293	2	56	1.4
	Tankage, 2½ parts	9			
	Soybean meal, 7½ parts	27			
	Alfalfa meal, 5 parts	18			
	Salt, 1 part	3½			
	Oystershell flour, 1 part	3½			
21	Rolled barley, 78½ parts	305	2	56	1.3
	Tankage, 2½ parts	10			
	Linseed meal, 12 parts	47			
	Alfalfa meal, 5 parts	19			
	Salt, 1 part	4			
	Oystershell flour, 1 part	4			
22	Rolled barley, 78 parts	275	2	56	1.4
	Soybean meal, 5 parts	18			
	Linseed meal, 10 parts	35			
	Alfalfa meal, 5 parts	18			
	Salt, 1 part	3½			
	Oystershell flour, 1 part	3½			

(Table 6 concluded on next page)

Table 6—(Concluded)

Lot no.	Ration used	Feed used per 100 pounds of gain, pounds	Number of trials	Average initial weight, pounds	Average daily gain, pounds
	Mixed and hand-fed twice daily—(Concluded)				
23	Rolled barley, 81 parts	285	2	56	1.4
	Soybean meal, 12 parts	42			
	Alfalfa meal, 5 parts	18			
	Salt, 1 part	3½			
	Oystershell flour, 1 part	3½			
24	Rolled barley, 75 parts	291	2	57	1.2
	Linseed meal, 18 parts	70			
	Alfalfa meal, 5 parts	19			
	Salt, 1 part	4			
	Oystershell flour, 1 part	4			
25	Rolled barley, 79½ parts	269	1	61	1.5
	Soybean meal, 12 parts	41			
	Alfalfa meal, 5 parts	17			
	Salt, 1 part	3½			
	Oystershell flour, 1 part	3½			
	Bone black, 1½ parts	5			
26	Rolled barley, 60½ parts	307	1	66	1.0
	Tankage, 2½ parts	13			
	Alfalfa meal, 5 parts	25			
	Lima beans, raw, ground, 30 parts	152			
	Salt, 1 part	5			
	Oystershell flour, 1 part	5			
27	Rolled barley, 60½ parts	230	1	66	1.5
	Tankage, 2½ parts	10			
	Alfalfa meal, 5 parts	19			
	Lima beans, steamed for 30 minutes, dried and ground, 30 parts	114			
	Salt, 1 part	4			
	Oystershell flour, 1 part	4			
28	Rolled barley, 60½ parts	226	1	66	1.4
	Tankage, 2½ parts	9			
	Alfalfa meal, 5 parts	19			
	Salt, 1 part	3¾			
	Oystershell flour, 1 part	3¾			
	Lima beans, cooked 2 hours, cooled, fed separately, 30 parts	112			

All data from California Agricultural Experiment Station feeding tests, except for corn tests, which are averages of several experiments reported in Pork Production, by W. W. Smith, revised edition, pp. 173 and 300; published by the Macmillan Company, New York City, N. Y., 1937.

Gleaning of stubble fields

(barley, rice, or wheat) is an important method of fattening hogs in California. But hogs should weigh at least 100 pounds before they are turned into stubble. Younger pigs will not gain well on stubble.

Two systems are used. In the more common one, no effort is made to provide any protein, either as pasture or supplement. Hogs are just turned into the stubble fields and kept there until they are fat or they have cleaned up the field. Water and shade are provided. This method produces excellent gains on rice stubble in the Sacramento Valley, where it is common practice. It is a practical and economical way to fatten hogs, and most of them are marketed directly from the stubble fields. Rice is better than barley or wheat subble.

In the second system, some producers provide alfalfa pasture in addition to barley or rice stubble. In some cases where there is no alfalfa pasture, tankage is supplied in a self-feeder.

Garbage feeding

in California is an important part of the hog business. Probably no other state has more large garbage-feeding plants than California. In normal times, one third of the hogs in the state are fed garbage as part or all of their ration. Garbage-fed hogs averaging about 220 pounds are marketed throughout the year.

From a nutritional standpoint, there is probably no difference between the pork from grain-fed hogs and that from garbage-fed hogs. However, the carcasses of garbage hogs are usually softer than those of grain-fed hogs. This is due to the larger amounts of oils and fats found in garbage. Because the carcasses are softer, garbage hogs often sell at a discount when hogs are plentiful.

Garbage-feeding plants cover fairly small acreages and are made up of alleys, feeding floors, shelter sheds, farrowing houses, and small lots. Fences are 1 × 6 inch boards or woven wire.

The farrowing houses are usually small. On one side of the farrowing pen is an outdoor pen with a concrete floor. On the other side is a small unpaved lot. While in the farrowing houses, the sows and their litters are fed garbage in the outside pen on the concrete floor (see illustration on next page).

The usual arrangement for fattening pens is to have an alley with a concrete feeding floor on either side. Feeding floors are usually 8 to 12 feet wide and have enough slope so that they can be thoroughly washed. Behind the feeding floors are lots with shelters. They provide exercise, shade in summer, and protection from rain and cold in winter.

A herd of 85-pound fattening pigs was put on a field of dwarf milo and cowpeas (left). Picture at right shows same field after "harvest."

This type of equipment is usually found in southern California and the central valleys. Around San Francisco, equipment and feeding methods are different because hogs usually are kept inside and only occasionally allowed to range outdoors.

No. 1 garbage, the best, comes from hotels, restaurants, hospitals, and Army and Navy camps. No. 2 garbage, which is more bulky, comes from city residential areas and the refuse from vegetable markets. Garbage feeders generally sign contracts on a tonnage basis. Garbage from Army and Navy camps is usually on a per-man-per-day basis.

In most cases, garbage is hauled by truck. However, garbage from Los Angeles is shipped by rail.

Pigs that are fed garbage are sometimes bought as feeder pigs; usually garbage feeders raise their own pigs. Experience has taught them that moving pigs long distances and changing from grain feeding to garbage feeding often cause heavy losses. Also, they have found that small pigs should be fed garbage at an early age so that their digestive systems can get used to the bulky feed. Most breeds do fairly well on a garbage ration, but Hampshires are preferred for this type of feeding in southern California.

Garbage is a bulky feed with fairly high moisture content, as Table 7 shows.

In most garbage feeding operations, only garbage is fed. In some, however, grain is also given. The more progressive feeders are beginning to feed more grain than they formerly did. In one of the largest plants, when pigs weigh about 100 pounds, they are self-fed grain and are allowed to consume what garbage they want. In other plants the sows are fed a little barley or other concentrates shortly before farrowing. In many establishments, it is common practice to feed both grain and garbage to the sows during part of their lactation period.

It is possible to keep garbage plants clean if the equipment is good. Most establishments clean up once a day by clearing off the feeding floors and then washing them clean with water and a broom. After the hogs have cleaned up what garbage they will, the uneaten bones are usually picked up and put in piles to dry. The other refuse is removed from the floors, spread about 8 inches deep on other concrete floors, and allowed to air dry. It is usually turned over once a day. When dry, it is ground, put in sacks, and sold as fertilizer.

Several serious diseases can result from feeding hogs raw garbage. These

Garbage is usually dumped onto concrete platforms where hogs can have access to it.

Table 7.—Feed Value of Garbage for Hogs

Type of garbage	Number of samples	Moisture, per cent	Composition of dry matter, in per cent of total dry matter				
			Crude protein	Nitrogen-free extract	Ether extract	Crude fiber	Ash
No. 1	2	71.3	17.0	39.0	17.7	13.7	12.4
No. 2	11	75.7	17.0	38.5	18.8	14.4	11.2

are probably caused by raw pork scraps from infected swine. One such disease is hog cholera (discussed on p. 48), another relatively new one is vesicular exanthema (VE). This is similar in appearance to foot-and-mouth disease, but differs from the latter in that it affects only swine.

NOTE

All ranches in California where garbage is fed to hogs are subject to regulation, as follows: Any ranch feeding garbage that is not cooked according to the instructions of the Director of the State Department of Agriculture is under continuous quarantine.

This ruling is in effect for the purpose of eradicating or sharply reducing the incidence of vesicular exanthema. Obviously, it affects the marketing of hogs since they cannot move out of a quarantined area. Therefore, any rancher who is feeding garbage, other than on an approved hog farm where it is being properly cooked, should contact the State Department of Agriculture.

Because of diseases such as these, some hog men cook garbage before feeding it to swine. For this purpose, government agencies recommend heating the garbage, in a fluid consistency, to the temperature of boiling water (212° F) and holding it at that temperature for one-half hour. (Cooking would also reduce the incidence of trichinosis. See p. 50.)

Coöperative research by the California Experiment Station has indicated that cooking of garbage lowers the feed value up to about 15 per cent. Although, in many cases, differences between raw and cooked garbage were small, groups of pigs fed raw garbage gained faster and utilized feed to a greater degree than did similar pigs fed cooked garbage. However, research at the Hawaii Experiment Station indicates that high quality garbage can be cooked with little or no lowering of feed value, and in other countries, cooking of garbage for swine feeding has been practiced successfully for years. In many cases, cooking of garbage would probably be economical, and is a recommended procedure.

For further detailed information on garbage feeding, refer to University of California Extension Circular 166, "The Garbage Hog Feeding Business in California."

How much feed does it take

to produce 100 pounds of live hog? Some answers are given by cost studies made by the California Agricultural Extension Service, in coöperation with hog producers. These and records on the University of California herd give the following figures for California:

If hogs are fed concentrate feeds in dry lot, it takes about 500 pounds of concentrates to produce 100 pounds of live hog in California. These figures are higher than those shown in some feeding tables in this circular because they include an allowance for the feed to maintain the breeding herd.

If pasture, farm wastes, and stubble are used, they replace some of the concentrates. On the average, they replace about 100 pounds of concentrates on California hog ranches.

How many pigs are marketed

per sow each year? The cost studies mentioned above give the following figures on numbers of pigs farrowed, weaned, and marketed in California. These figures have been checked with the opinions of hog producers.

Average number of litters farrowed per sow per year	1.6
Average number of pigs weaned per litter	6.1
Average number of pigs marketed per litter	5.7
Average number of pigs weaned per sow per year	9.8
Average number of pigs marketed per sow per year	9.1

Theoretically, it is possible to raise two litters a year, and many producers achieve this with most or all of their sows. But the average is considerably below this, because in practice there may be difficulties. On some farms, because of local conditions, there is only one litter a year. And some garbage plants raise about three litters every two years.

Losses among young pigs are high in most garbage-feeding plants because of their all-year breeding program and digestive disturbances among the pigs. These losses reduce the average pigs weaned and marketed per litter.

The best market weight

for both producer and consumer is from 175 to 235 pounds.

Hogs are sold to local butchers, shipped directly to packers, marketed through coöperatives, or consigned to commission firms for sale at union stockyards. A coöperative hog auction in the southern San Joaquin Valley and coöperative shipping groups in the Sacramento Valley have been highly successful.

It is good business to produce the kind of hogs the public demands and to sell them to the highest bidder, no matter who he is.

Market grades

for slaughter barrows and gilts and their carcasses were extensively changed in 1952 by the United States Department of Agriculture. These changes were made

Table 8.—Weight and Measurement Guides to Grades for Barrow and Gilt Carcasses*

Carcass weight† and length‡	Grade				
	Choice 1	Choice 2	Choice 3	Medium	Cull
	Average back fat thickness, inches§				
Under 120 lbs. or 27 inches	1.4–1.7	1.7–2.0	2.0 or more	1.0–1.4	less than 1.0
120–164 lbs. or 27–29.9 inches	1.5–1.8	1.8–2.1	2.1 or more	1.1–1.5	less than 1.1
165–209 lbs. or 30–32.9 inches	1.6–1.9	1.9–2.2	2.2 or more	1.2–1.6	less than 1.2
210 lbs. or 33 inches or more	1.7–2.0	2.0–2.3	2.3 or more	1.3–1.7	less than 1.3

* From Federal Register of August 13, 1952.
† Chilled, packer style carcass.
‡ Forward point of aitchbone to forward edge of first rib.
§ Average of measurements opposite first and last ribs and last lumbar vertebrae.

so that the grades could be used in a realistic manner and would have a definite relationship to the value of the carcass to the homemaker.

Since the 1930's, the comparative value of lard has decreased greatly. Formerly lard was more valuable, pound for pound, than was carcass meat. Today this is reversed. As a result, the homemaker wants as little fat as possible on retail cuts of meat. This consumer reaction is reflected in a demand by hog buyers for meat type hogs with a high yield of primal or lean cuts (ham, loin, Boston butt, picnic butt). Research has shown that the average back fat thickness, in relation to carcass weight or length, is a reliable index to the yield of primal cuts as well as to the general ratio of lean to fat in the carcass.

Three general grades of pork carcasses are now recognized—choice, medium, and cull. The choice grade is divided into three grades—choice 1, choice 2, and choice 3—on the basis of back fat thickness and primal cut yield. The choice 1 grade includes those carcasses with a minimum of back fat, and yet with sufficient condition to yield a firm carcass, firm belly, and choice cuts of meat. Choice 3 carcasses are overly fat, requiring excessive trimming of fat on the wholesale cuts, but still yielding choice cuts when trimmed. Choice 2 carcasses are intermediate. Medium and cull grades are for thinner animals.

Table 8 gives a schedule for grading carcasses.

In extreme cases, where use of weight and length gives different grades, final grade can be determined by consideration of other factors, such as length in relation to weight, conformation of hams, loins, bellies, and shoulders, and uniformity of width, depth, and fat covering.

Live grades are the same as the carcass grades—for example, a choice 2 carcass would be obtained from a choice 2 live barrow or gilt. In the case of the live animal, grading must be done by estimation.

The importance of meaty hogs cannot be overestimated. However, length and lack of condition can be overemphasized to the point where hogs will be poor doers and uneconomical. The desired type of hog can be found in all breeds of swine, and proper breeding and selection of this type can be carried out in any herd without the addition of a new breed. Desirable types, however, may be more easily found in some breeds than in others.

DISEASES, WORMS, and PARASITES can be discouraged by healthful surroundings.

Up to 35 per cent of all pigs farrowed die before they are marketed, according to reliable estimates. You can cut down your own losses from diseases, which may run into a good many dollars, if you will do these things:

1. Provide clean premises.
2. Keep your barns well lighted and ventilated.
3. Plow the lots close to the barn once or twice a year, and seed them to some annual crop, such as barley and rape. This helps to control roundworm infestation.
4. Scatter air-slaked lime in the pens and on the feeding floors occasionally.
5. Keep the troughs and feeding equipment clean.

These steps will help keep down infection and provide healthful surroundings for the growing pigs.

Hog cholera, pneumonia, swine enteritis, brucellosis, and parasitism are the diseases causing the heaviest losses in swine. It is essential that strict steps be taken to control these diseases, *including getting competent veterinary advice.* The suggestions given here will not take the place of a veterinarian.

Hog cholera

is caused by a virus and is highly contagious. Usually many animals are affected at once. The first signs are loss of appetite and high temperature, followed by weakness and staggering gait. Pigs usually die in 2 or 3 days after symptoms appear.

You can control hog cholera by vaccination with serum and virus, with serum alone, or with other vaccines, such as B.T.V. or crystal violet. Your local veterinarian can tell you which to use under the conditions in your herd.

Pneumonia

often causes heavy losses in swine of all ages. The symptom you can recognize most easily is heavy, labored breathing, or thumping, as it is sometimes called.

If you cannot get a veterinarian, separate the sick hogs and divide them into small groups. They should be housed with plenty of bedding and provided with water and a little feed.

Swine enteritis

is usually related to unsanitary conditions, overcrowding, and faulty nutrition, but its actual cause is unknown. If enteritis occurs, separate the affected animals, feed them a limited ration of bulky feeds, part of which might be wheat bran, and disinfect the premises.

Brucellosis,

also called infectious abortion, is caused by the porcine strain of the same abortion germ that causes Bang's disease in cattle. Some results of the infection in swine are sterility in gilts, loss of litters, pigs weak at birth, uneven size of pigs in the same litter, and litters with some pigs dead, others weak, and maybe a few strong ones.

There is no known cure or immunization for this disease at present. The only way to stop brucellosis is by preventive measures. The only sure way of knowing whether it is in your herd is by means of a laboratory test of a blood sample.

Brucellosis is very infectious. You can easily bring it into your herd by buying infected animals. If you are starting a

herd, or if your herd is negative, be sure that any hogs you buy are tested. *Never bring a positive reactor into a negative herd!*

The California State Department of Agriculture has set up a system of certifying brucellosis-free herds of swine. Any licensed veterinarian can conduct this program for you. You can get more information about it from the State Department of Agriculture in Sacramento or from your local Farm Advisor.

Pork measles

can be prevented by keeping human excreta away from pigs.

Roundworms

can be controlled by following the McLean County system, first used in Illinois. It gives excellent results.

Before farrowing season begins, wash and scrub the farrowing house thoroughly with scalding water and lye (1 pound to 30 gallons of water). Do an especially good job on the walls, partitions, and floors of the farrowing pens. Then disinfect the pen thoroughly with any standard disinfectant and put in fresh, clean straw.

Before putting the sow into this pen, wash her thoroughly with warm soapy water, especially her udder and underline, to keep her from carrying roundworm eggs into the clean pen. After she has farrowed and her pigs are strong enough, put them on clean, noninfested pasture. A pasture is considered noninfested if it has grown a crop since hogs were last on it or if it has lain idle for one or preferably two years.

Lice,

until recent years, were controlled by the standard method of using crude oil and other petroleum products. The use of these products has been unsatisfactory in many instances, and they have largely been replaced by the chlorinated hydrocarbon insecticides.

Some of the chlorinated hydrocarbons that have received considerable attention in hog lice control are DDT, benzene hexachloride, chlordane, and toxaphene. These compounds are applied as sprays, dips, and dusts. In most cases, one application is enough to eradicate lice.

DDT is effective in spray or dip concentrations of 0.50 to 0.75 per cent, and is usually used as a 1 to 5 per cent dust. Chlordane is used at 0.25 per cent as a spray or dip, and at 2 per cent as a dust. Toxaphene is very effective at 0.5 per cent as a spray or dip, and benzene hexachloride is used at 0.3 per cent concentration of its gamma isomer (lindane) in sprays and dips.

When using any of the above compounds, it is important to obtain complete coverage of the animal. This is most easily done by use of a dipping vat, but equally good results are obtained with careful spraying especially if pressures of 200 to 250 pounds are used.

It is important to follow the manufacturer's directions explicitly when applying the chlorinated hydrocarbons, and since these compounds are toxic to man as well as to animals, to observe all safety precautions.

Watch for lice on swine of all sizes.

Mange

should be diagnosed by a veterinarian if it appears in the herd. This is especially important because one form of mange (sarcoptic or common mange) is a reportable disease. This means that any cases must be reported to the State Department of Agriculture and treated under the supervision of its members.

The treatment of demodectic or follicular mange has not proved economical, and in most cases, swine infested with this disease are slaughtered. Chlordane, benzene hexachloride, and other compounds have shown promise when used against mites of this group, but the results are not always satisfactory.

Myiasis

is an infestation of wounds with maggots. To prevent it, first clean the wound with a 90 per cent solution of commercial benzol and then cover it with pine-tar oil or similar material. Carcasses should be burned.

Lungworms

get into hogs by way of earthworms. Therefore, if you keep pigs from rooting by ringing their noses, you reduce the chances of infection. The lots and pastures should be kept free of trash, litter, boards, and other debris. Good drainage will reduce chances of infection.

For kidney worms,

a precautionary measure is to have a bare area around the sides of the pasture and around the feed and water troughs.

Thorny-headed worms

can be stopped largely by keeping the pigs from rooting.

Trichina

infection can be reduced or perhaps wiped out by keeping the premises entirely free of rats. Garbage-fed hogs may develop trichinosis from eating uncooked pork scraps in the garbage.

CHECKING HOG RATIONS
shows whether the ration you feed is adequate.

If you feed the rations suggested earlier for the different ages and classes of hogs, your hogs should get the nutrients they need for normal growth. But you may have other feeds or prefer to use different proportions of the same feeds. You can find out whether the ration you are planning to use contains the needed food values by using tables 9 and 10.

It will pay you to check a new ration

with the tables. If you try to balance a ration by guess, one or two of the needed nutrients may be low enough to keep you from getting the best results. The failure of the pigs to gain all they might can cost you many times what it would cost to balance your ration.

Table 9 tells you how much

of each nutrient your hogs need. The amounts will be different for the breeding herd and for fattening pigs, and even for different weights of pigs.

Table 10 shows the amounts

of the nutrients found in 1 pound of many common hog feeds.

Table 11 shows how to use

tables 9 and 10. The sample ration given in table 11 is tested for a 100-pound pig hand-fed in dry lot. The steps taken in filling out the columns are listed.

When we compare the total nutrients in the ration with the amounts needed by the pig, this ration turns out to be adequate for its purpose. If the one you test is not, you can change the proportions of it or add other feeds to increase whatever nutrients are deficient. If protein is low, for example, you can increase the percentage of tankage or some other protein supplement.

If hogs are self-fed,

they usually balance their ration fairly well themselves, provided the feeds offered contain all of the needed nutrients, and provided the feeds are ones hogs like. But if, for example, you feed raw beans as the protein supplement, the hogs will not eat enough of them to get the protein they need. You can test whether they are getting a properly balanced ration if you know how much of each feed they are eating each day; the test is then made just as with the hand-fed ration in Table 11.

If you are feeding some liquid,

such as skim milk, you will need to make an allowance for the high water content. The total daily ration given in Table 9 is, you may note, on an air-dry basis. Skim milk and buttermilk are about 90 per cent water, so that for each pound of these you feed, you would count only 0.1 pound toward the total daily feed on an air-dry basis. But enter the full weight in column 3, because the amounts per pound in Table 10 are given on a wet basis.

If your hogs are on green pasture,

they will get some of their nutrients from that. Of course you cannot tell how many pounds of pasture your hogs are eating each day, but you can make some allowances for the nutrients they get from pasture. You can assume that they will get all the vitamin A and riboflavin they need, so that you will not need to give additional amounts of these. If the pasture is legume, it will supply a part of the protein needs and about 5 or 10 per cent of the total digestible nutrients. The feed mixture should supply the rest.

Table 9.—Nutrient Allowances for Swine
(Recommendations per pound of total feed—concentrate and forage)

Factor	Class of swine								
	Market stock					Breeding stock			
						Pregnant females and breeding stock		Lactating females	
						Young stock	Adults	Gilts	Adults
Liveweight, pounds	50.0	100.0	150.0	200.0	250.0	300.0	500.0	350.0	450.0
Expected daily gain, pounds	1.2	1.6	1.8	1.8	1.8	0.75	0.5	....	....
Total feed per day (air-dry basis), pounds	3.2	5.3	6.8	7.5	8.3	6.0	7.5	11.0	12.5
Total digestible nutrients, per cent	75	75	75	75	75	75	75	75	75
Crude protein, per cent	16	14	13	12	12	15	14	15	14
Calcium, per cent	0.65	0.65	0.55	0.55	0.55	0.6	0.6	0.6	0.6
Phosphorus, per cent	0.45	0.45	0.33	0.33	0.33	0.4	0.4	0.4	0.4
Salt (NaCl), per cent	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Carotene, milligrams	0.75	0.75	1.0	1.0	1.0	2.5	2.5	2.5	2.5
Vitamin D, I.U.	90	90	90	90	90	90	90	90	90
Thiamin, milligrams	0.5	0.5	0.5	0.5	0.5	0.5	0 5	0.5	0.5
Riboflavin, milligrams	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
Niacin, milligrams	6.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Pantothenic acid, milligrams	5.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Pyridoxine, milligrams	5.0	5.0	....	....	....	....	....	....	....

Data taken from "Recommended Nutrient Allowances for Swine," published by the National Research Council, Washington, D. C., 1944, 1950, and 1953.

Table 10.—Some of the Nutrients in Common Hog Feeds (Air-dry basis)

Feedstuff	Total digestible nutrients per lb.	Crude protein per lb.	Calcium per lb.	Phosphorus per lb.	Carotene per lb.	Thiamin per lb.	Riboflavin per lb.	Niacin per lb.	Pantothenic acid, per lb.
	per cent	per cent	per cent	per cent	mg	mg	mg	mg	mg
Grains:									
Barley	79	9	.06	.41	0.09	1.8	0.6	20.0	3.3
Corn	80	9	.02	.27	1.33	1.7	0.5	9.8	2.7
Oats	72	9	.09	.43	0.05	2.9	0.4	8.2	6.8
Rye	76	13	.01	.33	0.04	2.0	0.7	7.1	4.2
Sorghum, Kafir	82	11	.04	.33	0.13	1.6	0.5	18.3	5.7
Sorghum, Milo	80	11	.03	.27	0.08	1.8	0.4	13.1	5.7
Wheat	80	13	.05	.37	0.04	2.3	0.5	28.8	6.0
Mill concentrates:									
Rice bran	67	13	.08	1.36	....	10.3	1.4	129.1	17.9
Rice polish	81	13	.03	1.10	....	8.8	0.9	325.0	5.5
Wheat bran	67	17	.14	1.30	0.04	3.9	1.4	63.5	13.2
Wheat standard middlings	77	18	.09	.90	0.08	5.8	0.8	44.3	7.1
Protein supplements (plant):									
Cottonseed meal (41 per cent protein)	71	41	.23	1.18	0.09	1.8	2.5	13.0	6.4
Linseed meal (33 per cent protein)	77	35	.38	.86	0.12	3.9	1.9	18.9	8.0
Peanut meal (43 per cent protein)	82	43	.10	.50	....	3.3	2.4	77.5	24.7
Soybean meal (44 per cent protein)	79	45	.25	.68	0.10	0.8	2.0	16.7	10.1
Protein supplements (animal):									
Fish meal (63 per cent protein)	74	67	4.21	2.54	....	0.08	4.3	29.9	1.3
Meat and bone scraps (50 per cent protein)	65	51	9.70	4.20	....	....	2.1	21.4	2.4
Tankage, digester (60 per cent protein)	68	61	6.11	3.01	....	0.14	1.2	19.2	2.3
Skimmed milk (dried)	81	35	1.27	.10	....	1.5	10.0	5.7	16.0
Meat scraps (60 per cent protein)	70	61	6.30	3.50	....	0.1	2.5	23.7	2.3
Miscellaneous:									
Alfalfa meal (sun-cured)	54	16	1.50	.30	16.6	1.4	7.2	17.7	12.7
Alfalfa meal (dehydrated)	55	19	1.70	.28	43.4	3.10	7.4	17.3	18.5
Bone meal (steamed)	..	..	29.30	13.60	....	1.0	0.7	2.0	1.5
Molasses (beet)	61	8	.08	.02	....	....	....	22.0	....
Molasses (cane)	54	3	.74	.08	....	0.4	1.1	20.9	17.9
Potato meal	71	10	.08	.22	....	....	....	....	....
Whey (dried)	78	12	.91	.75	....	1.8	....	5.1	22.4

Data for T.D.N. and protein from same sources as Tables 1 and 2; data on minerals and vitamins from same source as Table 9, except for the carotene contents of alfalfa meals, which are from "Recommended Nutritive Allowances for Beef Cattle," published by the National Research Council, Washington, D. C., 1950.

HOW TO CHECK FOR AN ADEQUATE RATION

Table 11 shows a sample ration for a 100-pound pig. The same steps used in working out this ration may be applied to any other that you may wish to test. Here are the steps to follow:

1. Fill in the feeds contained in the mixture, in Column 1.

2. In Column 2, enter the amount of each feed used. NOTE: These figures are on the basis of 100 pounds of mix.

3. Multiply the amount of each feed in Column 2 by the amount of each nutrient in that feed. To find the latter figure, look at Table 10. Enter these values in columns 3 to 12. For example: Barley is 80 per cent of the ration. Table 10 shows that the total digestible nutrients value for barley is 79 per cent. Therefore, $80 \times .79 = 63$.

4. Total the figures in each column (3 to 12). These totals represent the nutrients in 100 pounds of feed. In the line below the totals, labeled "in 1 pound," fill in the amount by moving the decimal two places to the left for nutrients in requirements per pound (cols. 8 to 12 inc.). For example: In column 8, the total for carotene, per 100 pounds, is 91.2 mg. The total for 1 pound is .91.

5. On the bottom line (Amount required), fill in the allowances recommended in Table 9 for the type of hog you are feeding. For example:

Table 11.—Sample Ration for a 100-pound Pig—Is it Adequate?

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
Feeds used	Per cent of ration	Total digestible nutrients, per cent	Crude protein, per cent	Calcium, per cent	Phosphorus, per cent	NaCl, per cent	Carotene, milligrams	Thiamin, milligrams	Riboflavin, milligrams	Niacin, milligrams	Pantothenic acid, milligrams
Barley	80	63	7.2	.05	.33	—	7.2	144.0	48.0	1,600	264
Meat and bone scraps	4	3	2.0	.39	.17	—	—	—	8.4	86	10
Alfalfa meal	5	3	0.8	.07	.01	—	83.0	7.0	36.0	88	64
Soybean meal	10	8	4.5	.02	.07	—	1.0	8.0	20.0	167	101
Ground limestone*	1/2	—	—	.20	—	—	—	—	—	—	—
Salt	1/2	—	—	—	—	0.5	—	—	—	—	—
Total	100	77	14.5	.73	.58	0.5	91.2	159.0	112.4	1,941	439
In 1 pound	X	X	X	X	X	X	0.91	1.6	1.1	19.4	4.4
Amount required	X	75	14	.65	.45	.5	0.75	0.5	1.0	5.0	4.5

* Limestone is about 40 per cent calcium.

This sample ration is for a 100-pound hog. We find the recommendations for that weight in Table 9, in the second column under "Market stock." Checking down the column, we find that the amount of carotene required daily is .75 mg. This is entered at the bottom of Column 8 in the sample ration.

6. Compare the amounts in per cent and in 1 pound of the ration being tested with the amounts required, per pound, that appear on the bottom line of the table. If the calculated values are about equal to, or exceed the recommendations, the ration is adequate, provided the animals eat, daily, the number of pounds recommended in Table 9. For example: Table 9 shows that the total feed per day for a 100-pound pig should be 5.3 pounds.

Use this blank chart in testing the ration you are now using, to find out if it is adequate.

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
Feeds used	Per cent of ration	Total digestible nutrients, per cent	Crude protein, per cent	Calcium, per cent	Phosphorus, per cent	NaCl, per cent	Carotene, milligrams	Thiamin, milligrams	Riboflavin, milligrams	Niacin, milligrams	Pantothenic acid, milligrams
Total											
In 1 pound											
Amount required											

* Limestone is about 40 per cent calcium.

You may use this chart to test a new ration that you may be considering for your hogs.

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12
Feeds used	Per cent of ration	Total digestible nutrients, per cent	Crude protein, per cent	Calcium, per cent	Phosphorus, per cent	NaCl, per cent	Carotene, milligrams	Thiamin, milligrams	Riboflavin, milligrams	Niacin, milligrams	Pantothenic acid, milligrams
Total											
In 1 pound											
Amount required											

* Limestone is about 40 per cent calcium.

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